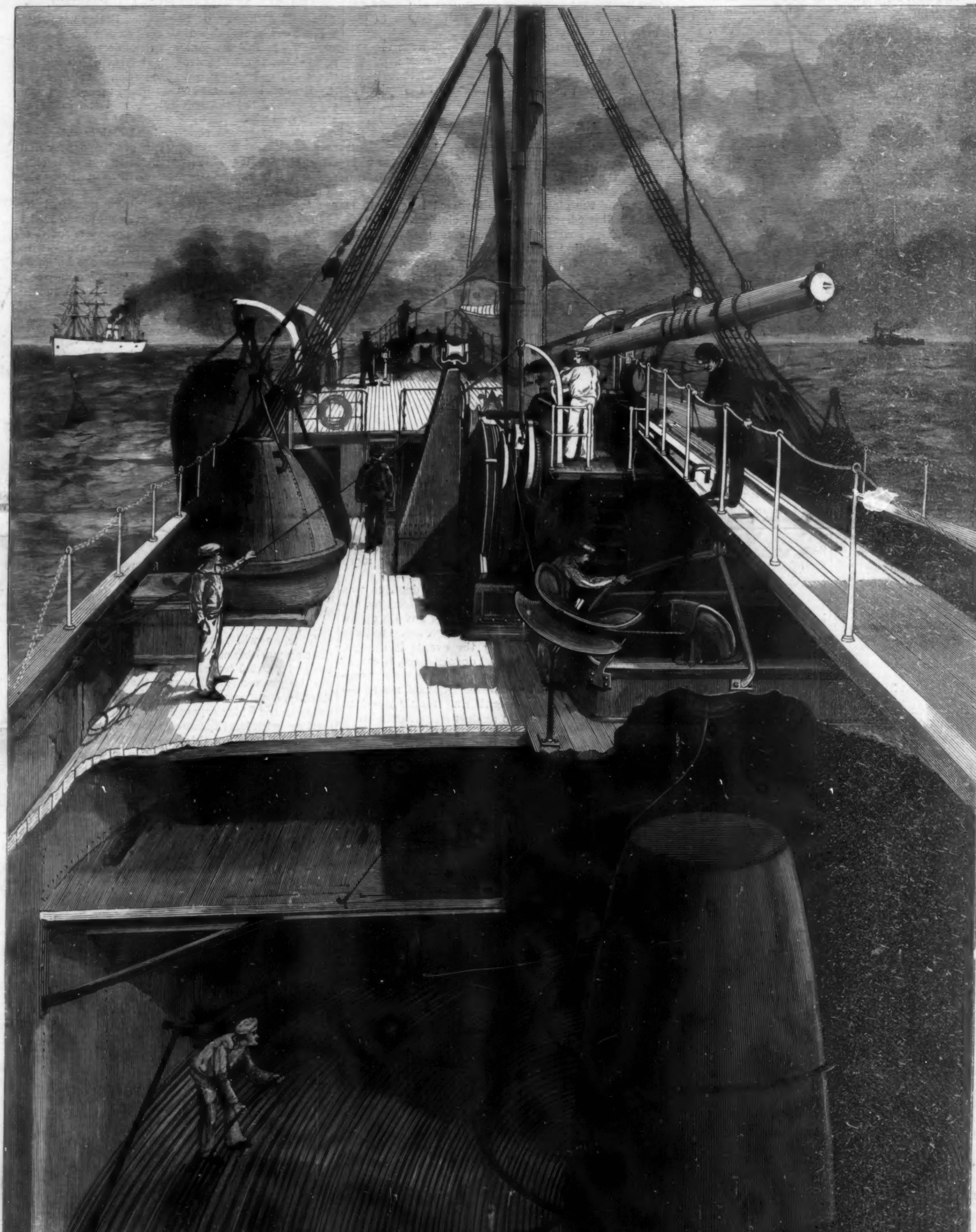
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1895, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIII.—No. 26.] ESTABLISHED 1845. NEW YORK, DECEMBER 28, 1895 [$3.00 A YEAR. WEEKLY.



THE COMMERCIAL CABLE CO.S REPAIRING STEAMER MACKAY-BENNETT—DECK, SHOWING ONE OF THE CABLE TANKS.—[See p. 409.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico..................$3 00
One copy, six months, for the U. S., Canada or Mexico............ 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year*.

Building Edition of Scientific American.

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American,

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade, may have large and handsomely displayed announcements published in this edition at a very moderate cost. MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, DECEMBER 28, 1895.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1043.

For the Week Ending December 28, 1895.

Price 10 cents. For sale by all newsdealers.

THE CRISIS.

The SCIENTIFIC AMERICAN occupies a unique position in the press of the United States. It is devoted to what may in the best sense be termed the arts of peace. It presents a view of the world of science and of practical achievement to its readers, the creative side of mankind having it as an exponent. In political economy sound doctrine regards destruction of life and of property as a world's loss, not as the loss only of the person or persons directly affected. The war between the States, now that thirty years have elapsed since its conclusion, still plays its baleful part in impoverishing the nation. During a part of its continuance its expense was put at one million of dollars per diem. Now it costs nearly one half of that in one single item of revenue expenditure.

The blue and the gray are again united; the evil passions awakened by war have sunk to rest; but the financial effects are still felt and will be felt for years to come unless they are overwhelmed by the weight of new misfortunes which may be brought upon us by another war. For, like a lightning stroke out of a clear sky, an issue is suddenly created between the United States and England, which, incredible as it would have seemed a week ago, may lead to war. If it does, the conflicts of past generations will sink into insignificance compared with the new one, and every quarter of the globe will be involved in a struggle which will put back the cause of civilization and of independent government to an extent which can be measurable only by centuries.

Out of the overgoverned nations have emerged two powers which represent the greatest freedom of government. These two nations are objects of jealousy and dislike to the rulers of almost despotic type which are over the older countries. In England, as in the United States, there is true representative government. The maintenance of the royal family is merely the figurehead of a monarchy and need rank as little more than as a harmless extravagance. The real government is as free and as representative as ours. If the two great powers which are representative of the highest degree of freedom in governmental affairs undertake an internecine war, it means the relegation of mankind to a still firmer grasp of despotic or imperial rule.

England in the past has been very aggressive. She has acquired great colonies by methods which her own historians and moralists condemn. Recently she seems to feel that she has enough, and her methods have changed, for the England of to-day is far different from the England of fifty years ago. Any accessions of territory she may contend for are sought by far more moderate methods than of old.

Some seventy years ago the Monroe doctrine was enunciated by the United States. This doctrine, opposing the increase of the territory of any European government on the western hemisphere, seems to have been justified at the time by the events in Europe. To-day, pushed to its utmost development, it would make us the guardian of almost all the western hemisphere. We should logically feel that we are at the beck and call of every neighboring South American republic to fight its battles against European powers. This is a pretty serious burden. It may lead to congratulatory messages from the countries whose cause we espouse, but it will act as a constant menace to our peace.

But the Monroe doctrine never will or can lead us into a more fatal consequence than a war with England. Our every interest is so tied up with her that whatever our animus may be, the contest would have the aspect of a civil war. The similarity of natures, the identity of language, the ties of blood relationship between the two countries, the friendship engendered by the great amount of intercourse which has of late years obtained between the two lands, are elements which would give to any contest the nature of fraternal strife. The business aspects of the case are no less serious. Our vast exports are sold to England and are carried in English ships. She is our great customer for cereals and cotton and other products in which we act as almost the world's purveyor. If a war occurs between us and our best customer, every blow we strike at her prosperity is a blow at our own.

The first week of the war would do incalculable millions of damage; the succeeding weeks would see republican and representative government made contemptible in the eyes of the world, while lives and property would be annihilated in battles of unimagined destructiveness.

The simple message of the President, which message seemed to threaten war, has already had far-reaching consequences. The fall in prices of securities and in produce represents an enormous aggregate. This would tend to bring people to their senses, unless by the perversity of human nature the misfortune be seized upon as an excuse or a reason for incurring others—a species of desperation which may find a precedent easily enough in the workings of human nature.

The finances of the United States, under what seemed to be conservative treatment, were progressing satisfactorily. Difficulties had arisen and had been met by the issue of bonds, and new issues were contemplated. All this went on smoothly because of the high credit of the country. Now, a week has changed it all. The further issue of bonds, in proportion as it becomes more difficult, appears more necessary. The very hopes of the Administration are defeated by its own act. The Christmas season of 1895 will be long remembered by those ruined in the crisis brought about by needless precipitancy. Already in the impairment of the value of securities and in the injury to the country's credit our standing, in a possible war, has been impaired.

THE NAVAL RESOURCES OF THE UNITED STATES AND THE BRITISH EMPIRE—A COMPARISON.

Captain A. Mahan, of the United States navy, has pointed out in his celebrated work on the influence of sea power in history, that a preponderance of naval power has been the controlling element which has ultimately brought victory to the nation that possessed it. His conclusions are largely based upon the European wars of the time of Nelson, and the late civil war in America.

In view of recent startling and ominous developments in the diplomatic relations of this country and Great Britain, it will be, we think, timely and interesting to inquire into the present status of the navies of the two countries, and also to inquire as to what are the battleship-building resources possessed by each. It should be noted that in the subjoined tables no account is taken of ships that possess a speed of less than 7½ knots per hour, or that are armed with obsolete smooth bore guns. Ships that are building, but within measurable distance of completion—such, for instance, as the Iowa—are included in the following tabulation:

FIRST-CLASS BATTLESHIPS OF THE LINE.

	Total number.	Average displacement.	Average speed.	Belt armor.	Total displacement.
United States	4 ships.	10,568 tons.	16·42 knots.	18 in.	42,274 tons.
Great Britain.	29 "	13,000 "	17·47 "	18 "	376,900 "

SECOND-CLASS BATTLESHIPS.

United States	3 ships.	5,703 tons.	16·7 knots.	12 in.	17,110 tons.
Great Britain.	12 "	9,502 "	18·63 "	14 to 24 "	114,030 "

THIRD-CLASS BATTLESHIPS.

United States	5 ships.	4,401 tons.	11·9 knots.	7 to 12 in.	22,020 tons.
Great Britain.	11 "	7,075 "	13·43 "	8 to 12 "	77,820 "

COAST DEFENSE BATTLESHIPS.

United States—The 6 knot boats armed with smooth bore guns are reckoned as obsolete.

Great Britain.	13 ships.	4,040 tons.	11 knots.	8 to 12 in.	52,530 tons.

TOTAL BATTLESHIPS OF ALL CLASSES.

United States.......... 12 ships, with a total displacement of 81,404 tons.
Great Britain.......... 65 " " " " " 621,280 "

In estimating the relative strength of the two navies from the above table, it must be borne in mind that the basis for comparison should be the total displacement, rather than the total number of ships. Displacement is the capital which the naval designer has to go upon; and if he make a judicious distribution of weights, he will always produce the more effective fighting machine out of the bigger ship. If a 10,000 ton and a 15,000 ton ship carry the same armament, the larger vessel will carry that armament more steadily, more speedily, with greater command, and, owing to the wider separation of the individual gun stations, with less exposure to disablement of guns and crew. Estimated on this basis, Great Britain possesses a superiority of fighting power in first-class ships-of-the line of 9 to 1. In battleships of all classes the superiority is 7½ to 1.

FIRST-CLASS ARMORED AND PROTECTED CRUISERS.
(Of 20 knots speed and upward.)

	Total number.	Average displacement.	Average speed.	Total displacement.
United States.	5 ships	7,700 tons	21·9 knots	38,500 tons
Great Britain...	9 "	9,233 "	21·0 "	83,100 "

FIRST-CLASS ARMORED AND PROTECTED CRUISERS.
(Of 19¾ knots and under.)

United States..	none	—	—	—
Great Britain...	21 ships	7,581 tons	17·0 knots	159,200 tons

SECOND AND THIRD CLASS PROTECTED CRUISERS.

United States...	14 ships	3,288 tons	18·23 knots	46,028 tons
Great Britain..	60 "	3,828 "	19·20 "	229,605 "

LOOKOUT CRUISERS.

United States..	5 ships	1,519 tons	16·73 knots	7,593 tons
Great Britain...	19 "	1,907 "	17·00 "	36,240 "

GUNBOATS.

United States..	7 ships	1,007 tons	16·00 knots	7,300 tons
Great Britain...	34 "	841 "	19·00 "	28,580 "

TOTAL CRUISERS OF ALL CLASSES.

United States........... 31 ships, with a total displacement of 99,421 tons.
Great Britain...........143 " " " " " 536,725 "

Estimated, as before, on the basis of displacement, this table shows a preponderance for Great Britain in cruisers of 5½ to 1.

Of merchant steamers which are built to meet the naval requirements for conversion into cruisers, the United States have 4 and Great Britain 26.

TORPEDO BOAT DESTROYERS BUILT AND BUILDING.

	Number.	Displacement.	Speed.
United States.....	—	—	—
Great Britain.....	62	250 tons.	28 knots.

TORPEDO BOATS.

United States.............................. 10
Great Britain..............................166

By displacement, the preponderance in torpedo boats is 40 to 1.

Summing up the totals for battleships and cruisers combined, we get:

United States...........	43 ships, with a total displacement of	180,895 tons.
Great Britain	208 " " " "	" 1,156,005 "

Which shows Great Britain to possess a superiority in fighting ships of all descriptions of $6\frac{4}{15}$ to 1.

In the event of a war with that country, these are the odds against which we should have to contend at the outset.

As against this unpromising opening it will be urged that we are a resourceful and energetic people, and that we should quickly create a navy. To this it must be answered that modern navies are of slow growth—they are not created. The modern battleship, costly and intricate, puts a heavy discount upon mere resourcefulness and energy, of which we have abundance, and a heavy premium upon gun, ship, and armor building plant, of which, for the magnitude of the task in hand, we should find that we possessed an altogether inadequate supply. With every factory, mill and shipyard working at full blast, it would take from seven to ten years to cancel that preponderance of $6\frac{4}{15}$ to 1.

There is no sentiment in statistics.

It is certain, moreover, that Great Britain would steadily add to her fleets as the war progressed; and with her great shipbuilding facilities she could float six ships to our one, as the following facts will show: In reply to inquiries instituted by the British Admiralty last year to ascertain the extreme warship building capacity of the private yards, it was found that, if these firms were given a free hand as to the details of the designs, they could build another navy, equal in fighting strength to the whole existing British navy, in from two to three years! To this must be added the building capacity of the government dockyards and shops. The astounding resources revealed by this investigation call for no elaboration on our part to show that Great Britain could rapidly increase her preponderance of naval strength, if challenged to do so.

The fact that European diplomats seem disposed to take the British view of the question at issue makes it highly probable that, in the event of hostilities, we should have to engage this colossal navy, with the power of reduplication which lies behind it, unaided.

Incidentally, in closing, we would remark that the ink is scarce dry upon the paper in which our general in chief, Nelson Miles, has just told us that the very opening of hostilities with a great naval power would see every sea-coast city, on the Atlantic and Pacific, subject either to the humiliation of an indemnity or to the horrors of bombardment.

In making the foregoing comparison it is assumed that the United States would not submit to a conflict merely defensive—that her enterprise would soon cause the field of naval operation to become conterminous with the shore lines of both hemispheres. The estimate consequently assumes that the total force of both fleets would be available.

THE UNITED STATES BUREAU OF STEAM ENGINEERING.

Engineer-in-chief Geo. W. Melville, in his annual report for 1895, recommends that the sum of $300,000 be spent in providing the cruiser Atlanta with new machinery and altering her from a single to a twin-screw ship.

According to Brassey's Naval Annual, the Atlanta is a steel cruiser of 3,189 tons displacement and 16·33 knots speed. She carries two 8 inch guns, six 6 inch, two 6 pounder quick-fire guns, two 3 pounder quick-fire guns, and eight smaller quick-fire guns.

It seems that, though her present engines are of an obsolete type, the hull is "an excellent one, and well worth new machinery." With machinery of 5,400 horse power (her present horse power is 3,511), of the same type as that in the newly constructed Marblehead, the report states that we should "then possess a cruiser equal to any of her class afloat." The new machinery would weigh 142 tons less than the old; it would enable the ship to carry more coal; and it would give her 2 knots higher speed, equivalent to between 18 and 19 knots an hour.

The same changes are recommended for the Boston, a sister ship. The Chicago is at present being re-engined.

In these days of high speed cruisers, the above addition of 2 knots to the speed of these boats will practically add two new ships to our navy.

The value of liquid fuel for marine purposes is being determined by a series of tests on one of the torpedo boats of the Maine. It is recommended that one of the gunboats building at Newport News be made use of to carry out these experiments on a larger scale. Naval designers the world over have for some time past recognized the fact that if the use of liquid fuel can be rendered practicable in the navy, it will largely increase the radius of action of seagoing ships. To the United States the question of the use of petroleum fuel is of double importance, both on account of the abundance of our supply of this combustible and even more on account of our paucity of coaling stations. The range of action of the modern warship is limited by her coal capacity and the distance of her field of operations from the nearest coaling station.

A nation which possesses few of these must provide its ships with specially large bunker space, as in the case of the cruiser Columbia. Any device which will enlarge the fuel endurance of warships will be specially valuable to the United States; and there is nothing in sight to-day which would so effectually do this as the substitution of oil for coal in marine boilers.

Speaking of the use of water tube boilers in the navy, Mr. Melville recognizes the necessity for a boiler lighter than the well known Scotch boiler; and while admitting that many types of the water tube system have proved successful on shore, he is of the opinion that "no single type has yet made its appearance which can be regarded as an altogether satisfactory substitute for the Scotch pattern."

In view of the fact that the two cruisers Powerful and Terrible, of 14,000 tons displacement, now building for the English navy, are to be furnished with boilers of this type, the above statement by so distinguished an authority is significant. Mr. Melville evidently considers that for use in large ships the water tube boiler is yet in the experimental stage; and his opinion is shared by many naval experts on the other side, who strenuously opposed their adoption in these two costly ships.

THE JANUARY SKY.

Jupiter is still the only planet conveniently situated for observation. He rises now about 7 o'clock in the evening, so that by 10 o'clock he is well above the roofs and trees. The position of this planet among the stars is very interesting just now. On the first of January he is quite close to the fourth magnitude star δ Cancri, and a little south of the Beehive cluster in Cancer. Not only is a means thus offered by which those unacquainted with the stars may, with certainty, recognize this curious stellar region, but the picturesqueness of the view is increased, and a more striking idea of the profundity of space may be formed when one sees the united light of hundreds of distant suns outshone by the reflected rays from a comparatively nearby and insignificant planet.

Yet, although Jupiter may be called insignificant when compared with a sun, he is anything but insignificant when studied in his own character of a giant planet. It is an impressive thing, to any thoughtful person, to look upon a globe 1,300 times as large as the earth, and contemplate the bare possibility of its being inhabited, either now or at some future time. If I were asked, "What is the most instructive sight that the telescope reveals in the heavens?" I should be strongly tempted to reply, "The planet Jupiter, with his circling moons." There—and it is a spectacle not reserved for the possessors of the largest telescopes—one perceives the law of gravitation operating visibly on an enormous scale; one sees globes larger than the moon tracing out elliptical orbits so swiftly that a single evening's observation plainly reveals their change of place; one beholds eclipses with their mechanism displayed as the finest model could not do it; and the play of shadows on the face of another planet; and the movement of clouds; and the alignment of zones, shading off from a brilliant equator to dusky poles; and the rapid turning of a vast world upon its axis of rotation.

In reference to this rotation, I may remark that now, when the planet is visible the entire night, an excellent opportunity is presented to see one complete turn of Jupiter on his axis. Let the observation begin at 8 P. M. and end at 6 A. M. Between those hours the observer will have seen all sides of the giant planet in succession, and when he leaves the telescope the face of Jupiter will have resumed the appearance it had at the time his eye was first applied to the tube. And in the meantime he will have beheld many a scene that has puzzled the astronomers, for the surface of Jupiter is strangely and wonderfully variegated.

Venus is in Libra near Scorpio, and rises on the 1st of the month about 4 o'clock in the morning. At the end of January she will be in Sagittarius, rising about 5:30 A. M. Her reign is passing and will not be resumed until she reappears in the sunset next autumn.

Mercury is in Sagittarius at the opening of the month, too close to the sun to be observed, but about the 23d, when he is in the eastern part of Capricorn, he will be visible in the evening, more than 18 degrees east of the sun.

Mars is in Ophiuchus, moving toward Sagittarius, and on the 1st rises about 6 A. M.

Saturn remains a few degrees east of α Libræ, rising on the 1st about 3 A. M. and on the 31st about 1 A. M. But there are few who will care to break their rest even for the sake of beholding that most singular of celestial objects, a planet with rings, especially since, in the spring, Saturn will rise early in the evening.

Uranus is in Libra, not very far east of Saturn, and Neptune is in Taurus, well situated, but too faint for satisfactory observation, even with a telescope of considerable power.

The moon is waning when January opens, although but just past the full by a few hours. New moon occurs late in the afternoon of the 14th; first quarter on the evening of the 22d in Aries; full on the morning of the 30th in Cancer.

Perigee occurs an hour before midnight on the 3d, and apogee about the same hour of the night on the 19th. The moon is in perigee for a second time this month on the evening of the 31st.

The lunar conjunctions with the planets occur as follows: Jupiter on the 2d just before midnight (the planet will be less than 2° south of the moon, a pretty sight); Saturn on the evening of the 9th, invisible; Uranus on the morning of the 10th; Venus on the morning of the 11th; Mars on the morning of the 12th; Mercury on the morning of the 16th, invisible; Neptune on the morning of the 26th, invisible; Jupiter (second time), before sunset on the 29th.

The wonderful variable star Algol, in Caput Medusæ, is now well situated for observation. It will be at a minimum on the 9th, half an hour after midnight. The observer should begin to watch it, using either the naked eye or an opera glass, early in the evening, noting the gradual diminution of its light as compared with the small stars near it. It remains at minimum but a few minutes, although three or four hours are required for it to regain its full brilliance. Another minimum occurs on the 11th, at 9:23 P. M.

The star Myra, in Cetus, which is as remarkable among long-period variables as Algol is among short-period ones, is now brightening. It began to be visible with a field glass about the middle of December, and it will probably increase in brilliance for about two months. When brightest, it is sometimes of the third magnitude.

An occultation of the first magnitude star Regulus, or α Leonis, by the moon, will occur about ten minutes before 11 o'clock P. M. on the 3d.

The earth arrives at that point in its orbit which is nearest the sun at 1 o'clock on the afternoon of the 1st.

GARRETT P. SERVISS.

TO READERS AND SUBSCRIBERS.

The present number of the SCIENTIFIC AMERICAN brings to a close the labors of the year, and the next issue opens a new volume, a fresh page in the history of our work. To our many readers and friends, in all parts of the world, we offer hearty thanks for their generous support in the past, and we hope to merit the continuance thereof by faithful endeavors in the future.

The commencement of the year is the time when nearly all subscriptions fall due, and we trust our subscribers will be prompt in forwarding their remittances, thus avoiding the loss of numbers by the crossing off of their names. We earnestly hope they will send us, along with their own dues, the additional subscription of some friend or neighbor.

For this festive season it would be difficult to select a more desirable or appropriate gift than a year's subscription to the SCIENTIFIC AMERICAN publications. In the office, the shop, the library, the household, the SCIENTIFIC AMERICAN is always a welcome visitor, attractive, instructive and useful for every one.

The terms for the SCIENTIFIC AMERICAN remain as heretofore—$3 a year, postage paid by us. SCIENTIFIC AMERICAN SUPPLEMENT $5 a year. Both papers combined, $7 a year. BUILDING EDITION, $2.50 a year. All three publications $9 a year. Address Munn & Company, publishers, 361 Broadway, New York.

Cycle Notes.

Two bicyclists, Theodore and Eddie Kragness, arrived in San Francisco a week ago, having ridden on their machines all the way from Minneapolis. The route they traveled was 2,856 miles long, and they rode it in thirty-eight days, an average rate of seventy-five miles a day. Some days they rode more and some less, and occasionally they rode until nearly midnight in order to keep up the average. They did not make the trip for money or glory, but for pleasure. They had very trying times on the windy prairies, the sandy deserts, and the snow-covered mountains, and will not try to ride back again. They carried a tent, blankets, cooking utensils, and also food on the long desert stretches, although in the main they relied for shelter and food on the farmers.

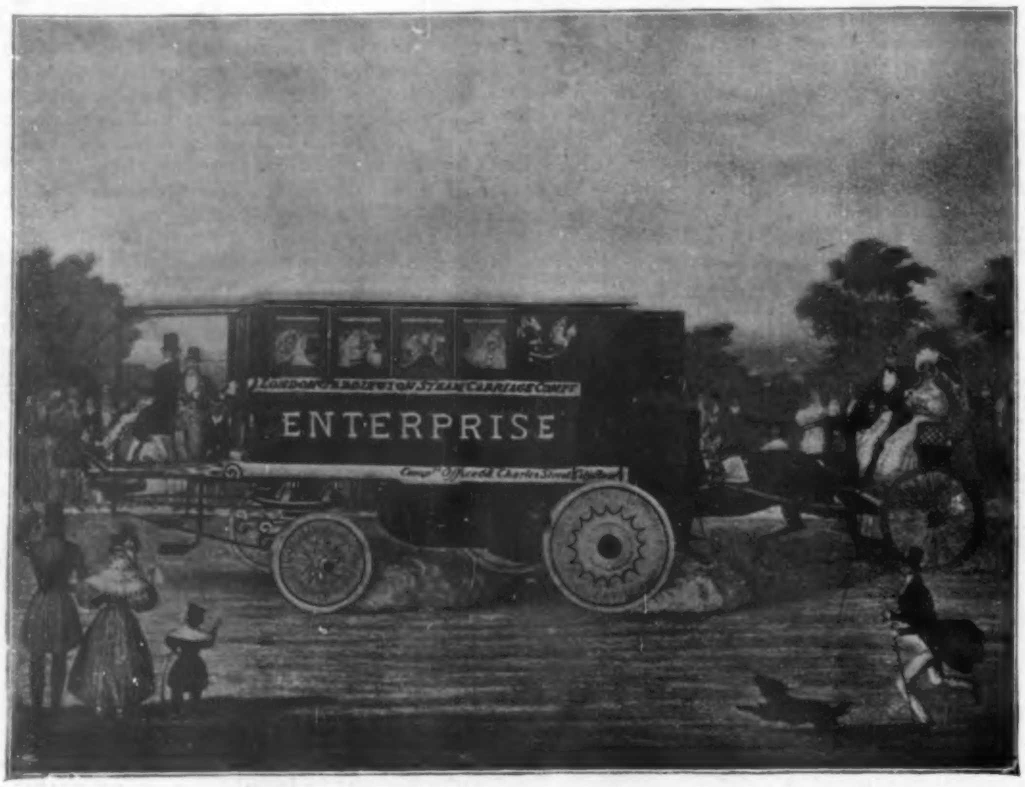
It is said the Bavarian Minister of War has authorized the purchase of 9,000 cycles which are to be used for the infantry and sharpshooters.

A proposition has been made recently by bicycle riders to several agents and manufacturers of bicycles that the manufacturers get together in a convention and agree to reduce numerous parts of their different machines to standard proportions.

In some respects the makers have been obliged already to agree upon standard sizes or parts, such as rims and tires. There is no reason why a similar agreement should not be reached regarding the fittings of almost every part, so that any repair shop, supplied with a reasonable quantity of standard repair parts, should be able to put any make of machine in order at short notice.—N. Y. Sun.

A STEAM OMNIBUS IN LONDON, 1833.

The accompanying illustration, for which we are indebted to the St. James's Budget, represents the steam omnibus Enterprise, built for the London and Paddington Steam Carriage Company in 1833. This horseless carriage, suggestive as it is of many of the recent attempts to attain a practical motocycle, was one of the various efforts made to utilize the steam engine in its early days, before the development of the railway system had been marked out on comparatively fixed lines.



A STEAM OMNIBUS IN LONDON, 1833.

THE ELECTRIC SELF-PLAYING PIANO.

We illustrate in the present issue an electric apparatus for attachment to any ordinary piano, enabling it to be played by electricity without the intermediation of any performer. The characteristic features of the appliance are found in its simplicity, its capability of attachment to any piano without injury to the same, and its use of standard perforated music, thus placing at the disposal of its possessor a practically unlimited and thoroughly up to date musical library.

Directly under the keyboard is attached the music holder, consisting of the rolls upon and from which the perforated music sheets are fed. Electric contacts are provided for each note, which contacts operate through the perforations in the music sheet, so that each perforation closes an electric circuit. From the electric contact wires run to a series of electric magnets placed below and spaced from each other exactly as are the keys of the instrument, one magnet corresponding to each key. When the current passes a magnet attracts its armature, this occurring of course when one of the perforations of the music closes the circuit. A small sectional drawing shows in section the apparatus by which the work is done. At the bottom of the section is seen the end of a long brass drum which runs across the bottom of the apparatus and which is kept in constant rotation by an electric motor; this drum is also shown clearly in the perspective view. Extending from the end of the armature of each magnet is a metal friction shoe, the lower end of which forms a segment of a circle and is arranged to be brought in contact with the brass roller. A piece of rawhide is stretched over and cemented to the outside of the segment. When the armature is depressed, no direct effect is produced upon the action of the piano. All the depression of the armature does is to bring the rawhide-covered face of the circular segment into contact with the rapidly rotating drum. At once the friction throws the arc forward. From the upper end of the metal shoe a short arm projects at right angles, like the arm of a bell crank. From this a vertical striker arm rises and presses against the inner end of the key. It is evident that as the shoe is thrown forward the striker rod is forced upward; this raises the inner end of the key, depressing the outer end exactly as a performer would do, and the note sounds. It will be observed that the action of the piano is absolutely unaffected by the apparatus, whose motions bear the same reference to the piano as do those of an accomplished performer. This is so far true that a piano fitted with this apparatus is absolutely unaffected as regards its capacity for being played by hand. In the sectional view, the music holder can be seen, and one of the electrical contacts is shown pressing upon the sheet as it passes over a small central contact roller. Within the short width of the sheet of music are contained all the electric contacts, of which only one is shown in the sectional view. In operation, the music is wound off of one roller and on another. When the roll of music is exhausted, it has to be rerolled before the piece can be played again. This ordinarily, in the past type of automatic instruments, has been effected by hand, but this apparatus does that work also automatically. When the end of the piece is reached, the detent seen at the back of the music is caused to release the end of the carrier, which drops, and the rollers immediately begin to revolve with reverse motion, and in less than a minute the piece of music is rolled back on its original roller, ready to be put away in its case or to be played again.

ELECTRIC SELF-PLAYING PIANO.

The tempo of a piece is fixed by shifting a belt which works on two cone pulleys. In this way the speed can be regulated with the utmost delicacy, the coning of the pulleys preventing all sudden change of time. The motor is seen in the base of the piano. It consumes from five to ten amperes at a pressure of four volts, ten amperes being required when several notes at once are sounded, as in chords.

The apparatus can be put in any piano without moving from the house, and the motor can be operated directly from the electric house supply or from a primary or secondary battery.

This wonderful piano is manufactured and sold by the Electric Self-playing Piano Company, 333 West 36th Street, New York.

The London Police.

The report of the Commissioner of Police of the Metropolis for 1894 shows that the authorized strength at the end of last year was 15,216. The number available for service, exclusive of those specially employed, whose services were paid for, was 13,497. The Metropolitan Police district embraces over 688 square miles. The mean ratable value of this area was £37,913,956; but of the enormous actual value of the property in charge of the police it is impossible to form any estimate. The report refers to the steady decrease in the number of felonies. While the population exceeded 6,000,000, the proportion of crimes against property per 1,000 of the population was but 3·106. The cases of murder were but 13, which is considerably below the average; and of these, 7 were due to insanity.

The cases of attempts to murder, wounding, etc., rose to 243, which is unusually high. The total number of criminal offenses of all kinds reported to the police was 20,970—a decrease of 497. The apprehensions numbered 14,902. As regards police work generally, including crime, the number of persons apprehended was considerably in excess of any previous year, and as compared with 1893 there was an increase of 3,346. The summary convictions showed an increase of 1,948, and were more numerous than ever before.

The Brooklyn Institute Museum.

The corner stone of the great museum building of the Brooklyn Institute of Arts and Sciences, on the Eastern Boulevard, Brooklyn, N. Y., facing Prospect Park, was laid on December 14 by the mayor of the city with appropriate ceremonies.

BICYCLE POWER AIR PUMP.

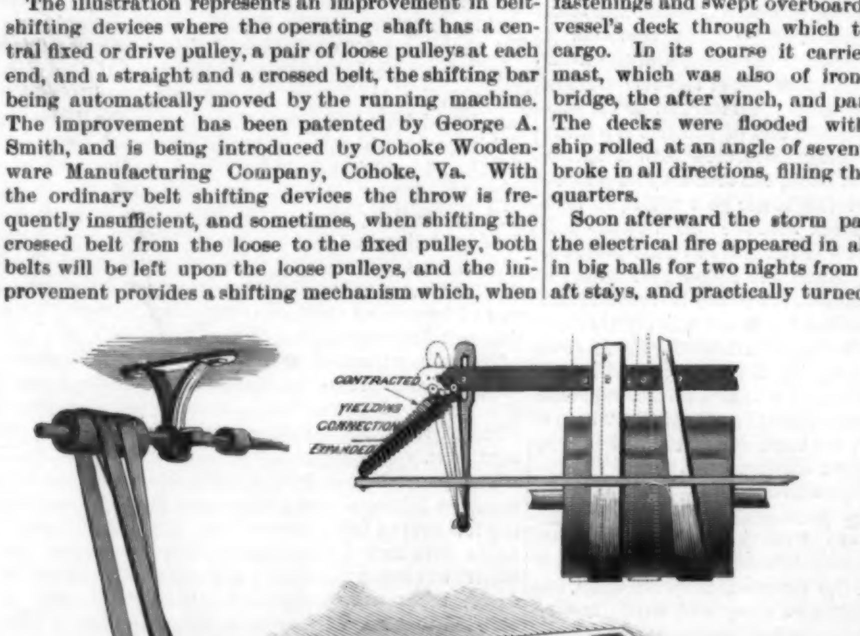
The illustration represents a highly efficient apparatus more especially designed to serve the convenience of bicycle manufacturers for inflating pneumatic tires, and for which a patent has recently been granted to Frank N. Stevens, of the Davis & Stevens Manufacturing Company, Seneca Falls, N. Y. The pump is double acting and has two oscillating brass cylinders, each two by eight and one-half inches and each screwing at its lower end into a head with trunnions turning in bearings on the base, there being in the bottom of each head a packing ring which makes a very tight joint to prevent leakage. The piston rods, extending through the open ends of each cylinder, connect with

THE STEVENS POWER "CYCLONE" PUMP.

crank disks on a driving shaft on which are tight and loose pulleys eighteen inches in diameter, the disks having their wrist pins set opposite each other, so that the pistons compress the air alternately to insure a continuous operation of the pump, which is also adapted to be operated by hand power. Each piston is formed with a cup of leather or rubber, into which fits an expansible disk or spreader with slotted flaring sides, in which washers are held by a nut screwing on the lower threaded end of the piston rod, so that the sides of the cup are made to form a close contact with the inner surface of the cylinder. The valve casing at the bottom of each tube has an outlet valve communicating with a tube which is connected near its middle with a tank or reservoir in which the compressed air is stored, this tank being made of different capacities and being provided with pressure gage, safety valve and stop cock. The construction of the pump is such that any part may be readily repaired in case of wear or injury.

AN AUTOMATIC BELT SHIFTER.

The illustration represents an improvement in belt-shifting devices where the operating shaft has a central fixed or drive pulley, a pair of loose pulleys at each end, and a straight and a crossed belt, the shifting bar being automatically moved by the running machine. The improvement has been patented by George A. Smith, and is being introduced by Cohoke Woodenware Manufacturing Company, Cohoke, Va. With the ordinary belt shifting devices the throw is frequently insufficient, and sometimes, when shifting the crossed belt from the loose to the fixed pulley, both belts will be left upon the loose pulleys, and the improvement provides a shifting mechanism which, when acted upon by the first part of the movement of the operating rod or bar on the machine, stores up power sufficient to cause the shifting bar to move continuously to the completion of its stroke. The larger view shows the improved device applied to a grinding machine, where the front end of the shifting bar is pivotally connected to the inner crank end of a rocker or vibrating member, which has on its outer end a corresponding crank arm adjustably connected by a stout coil spring with the operating rod or bar on the frame of the machine, stops on the latter bar being engaged by the carriage at the end of each reciprocal movement. Eyes at the ends of the coil spring afford means for adjusting the tension of this yielding connection, by which power is stored up to continue or complete the shifting action of the shifting bar, and make positive the shifting of the belts. The smaller figure shows the position of the belts and the shifting bar in full lines, the dotted lines indicating the position to which they are brought by the yielding connection, such position being attained instantly after the carriage and operating shaft is momentarily stopped, the fast pulley having been freed of either of the belts.



SMITH'S AUTOMATIC BELT SHIFTING MECHANISM.

Fire Balls at Sea.

One of the most remarkable electrical storms at sea, which probably seemed intensified by reason of the fact that a cargo of Spanish iron ore passed through it, was experienced by the British steamship Mercedes, which arrived at this port recently from Bilbao. On the Grand Banks of Newfoundland during the nights of December 3 and 4 the ocean appeared like a mighty mass of flames or an endless stretch of prairie fires. Balls of electric fire hissed and exploded in all directions and darted among the vessel's masts and rigging.

The Mercedes' escape from going down on December 1 seemed little short of a miracle. She was struck by a south-southwest gale, which was accompanied by seas rolling fearfully high. During the height of the storm a huge deck derrick, weighing many tons, was torn loose from its fastenings and swept overboard, leaving a hole in the vessel's deck through which the water ran into the cargo. In its course it carried away the maintopmast, which was also of iron; part of the flying bridge, the after winch, and part of the deck fittings. The decks were flooded with tons of water, the ship rolled at an angle of seventy degrees, and the sea broke in all directions, filling the cabin and the officers' quarters.

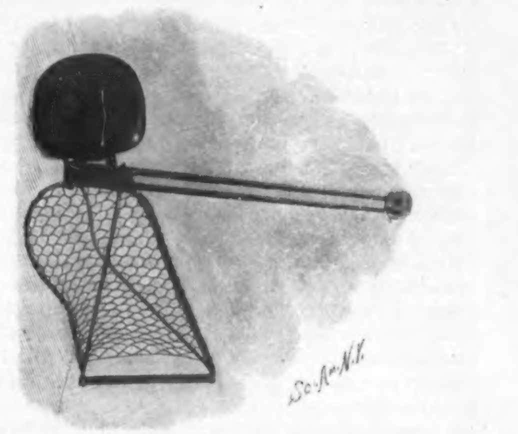
Soon afterward the storm partially subsided, when the electrical fire appeared in all directions. It hung in big balls for two nights from the masts and fore and aft stays, and practically turned night into day. As the big fire balls came together they would burst with a loud report upon the vessel and disappear. Under this light at night such temporary repairs were made as were deemed necessary to reach port.

Captain Tait of the Mercedes stated that the passage was one of the most trying experiences of his life. The rolling and lurching of the vessel in the storm and the fury of the gales were terrific in the vicinity of 25° longitude. Only the heroic work of the officers and crew saved the vessel.—Phila. Record.

ALUMINUM is being used in making the bodies of cabs.

A BICYCLE ADAPTED TO CARRY TWO PERSONS.

To facilitate carrying on the ordinary wheel a passenger in addition to the one who is propelling the machine, and to hold a lady's skirts out of contact and entanglement with the wheels, the improvement shown in the accompanying illustration has been patented by Harry J. Getman, and is being introduced by Henry A. Lederle, of Traverse City, Mich. It consists of an elongated clip frame attachment, shown separately in the small view, and composed of two parallel rods joined at the front by a block, and connected to the rear upright by a bolt, the front portions of the frame resting on the collar of the bicycle frame. Securely attached to the front of the clip frame is a transversely bent rod extending to one side, on which is a seat, while bolted rigidly to the opposite side of the clip frame is a skirt or leg support, composed of a framework of metallic rods, over which is secured wire gauze or netting. This support extends rearwardly and outwardly from the left hand side of the machine, and curves downwardly from the clip frame, to conveniently support the limbs and skirts of the person on the forward seat and afford such a balancing of the weight as will prevent undue torsional strain of the parts, and avoid liability of breaking or bending.



LEDERLE'S BICYCLE ATTACHMENT.

Force of the Human Jaws.

Experiments are reported to have been made by Dr. Black, a dentist of Jacksonville, Fla, to determine the force exerted by the human jaws in chewing food, and also the greatest force which the jaws are capable of exerting. By means of a spring instrument provided with a registering device he took—according to the account given—records of about one hundred and fifty bites of different persons, fifty of these being preserved as characteristic of the ordinary man, woman, and child. The smallest pressure recorded was 30 pounds, by a little girl seven years old, with the incisors, but, using her molars, the same child exerted a force of 65 pounds. The highest record was made by a physician of thirty-five, the instrument used registering only 270 pounds, and he simply closed it together without any apparent effort, there being also no method of determining how far above that figure he could have gone, and the test was made with the molars. Several persons exceeded a force of 100 pounds with the incisors and 200 with the molars. Dr. Black states that the physical condition of the persons experimented upon seemed to but slightly influence the result, and he is of the opinion that the condition of the peridental membranes is the controlling factor, rather than muscular strength; and further, that in the chewing of food much more force is habitually exerted than is necessary.

The Chiffonniers of Paris.

Ragpickers' Town reminded me of some ancient, tumbledown fishing village, and certainly it was hard to realize that this was positively the city of Paris at the end of the nineteenth century. Space, it would seem, was at a premium in the Cité Doré, for utensils of different kinds ornamented the outside walls, and here and there a cradle swung lightly from its rusty nail. Many of the houses boasted of but one room, in which were, often, neither furniture nor bedding; a bundle of rags did duty for the latter, and in truth it was a case of rags, rags, raggedest of rags everywhere. The ragpickers were seated on their thresholds, or as near the door or apology for a window as it was possible to get. Here and there an ancient chiffonnière was patching together old remnants, but most of the men were classifying their merchandise spread upon the floor. These were the trieurs or sorters, whose business lay in dividing the odds and ends into their various classes before reselling them to the merchants en gros. The white rags had to be sorted from the colored, and the silk from the cotton or woolen. The woolen ones, I found, were prized the most, as they brought in nearly thirty francs the 100 kilos, while the silk were worth only seven. The chiffonniers collect over 50,000 francs' worth of pickings in one day (statistics of 1889), and nothing comes amiss to them.

I begged permission of an old chiffonnière to sketch her as she sat at her mending, and then the motley crowd, which had all the time followed closely at my heels, promptly surrounded me. The elders did not appear to view my movements with much favor at first, but their scowls were soon turned into broad grins by a general distribution of the cigarettes. The packet could not go all round, it is true, but it went far enough, at least, to make the inhabitants of the Cité my friends. They were a tough enough looking set, on the whole, but most of the older women appeared to suffer with inflammation of the eyes, and many of the children also—a thing easily to be accounted for by a glance at their grimy hands. Still the eye trouble was the only one which affected them very much apparently. Though irredeemably dirty, the children looked bright, happy, and healthful. And they had reason to, living as they were in an open quarter of low houses, where the sun could stream down on them and the air play around them—a sensation rarely to be experienced in the narrower Paris streets, where the immense height of the apartment houses keeps off, for the greater part, these two most important health factors. The young girls, too, had evidently their share of hardiness, and, with it, a sturdy independence of manner, not unbecoming the daughters of this liberty-loving race, and there were several quite pretty enough to warrant the existence of that romantic play of Bourgeois and Emery's, La fille du Chiffonnier, which created so much interest on the boards of the Ambigu a little while ago.

When I had made the round of the Cité, I attempted one or two sketches, and wherever I stopped, every window within sight would immediately become alive with heads partially obscured by the flapping rags which hung before most of the houses. I caught one old chiffonnière watching me complacently as she ate her supper, and called up to her to tell me, if she would, which was her quarter for collecting. She answered proudly, "The Opera," much to my surprise, for that part of Paris is five or six miles away. But I learnt that this neighborhood and the Chaussée d'Antin were the fat livings of the chiffonniers, and that a placeur will sell his right to empty the rubbish boxes of a few houses there for as much as 150 francs; for, although a coureur or roving chiffonnier's daily collection is seldom worth more than 1 franc 50 cents, that of the placeur, or chiffonnier with a regular situation, often amounts to seven or eight times that sum, and necessitates his bringing a hand or even a donkey cart.

It is chiefly in suburbs such as Malakoff, Ivry, and Gennevilliers that the chiffonniers now congregate, though formerly they were to be found in Le Petit Mazas, Le Passage du Soleil, La Cité Maupy, and La Cité de la Femme en Culotte, which last, though now destroyed, once brought its eccentric landlady, Mademoiselle Foucault, 12,000 francs per annum. But it is the Cité Doré as the home of the chiffonniers which is of special interest, partly on account of the historic records in connection with it in the reports of "Commission des Logements insalubres" (1853), on account of the many controversies over it, notably in the Revue Municipale (1859–60) and because of the personal supervision still exercised over it by Monsieur Doré's daughter from her manor overlooking it. This was once the Château of Bellevue, which up till 1848 was surrounded by its park of 10,000 square meters. After that date, Monsieur Doré cut the ground up into little lots, and let it out to horticultural-loving Parisians at 5d. the meter per annum.

An enterprising chiffonnier not only rented one of these, but with the aid of sardine boxes filled with clay, bits of old building material and tin, built himself a hut. He was the envied of all the crowd of chiffonnier friends who came to wonder and admire, and who were not long in following suit. They formed themselves into an independent republic to the number of 400, which by 1860 had increased to between two and three thousand. Until the speculators appeared upon the scene, the chiffonniers were thus their own landlords, which fact created in them that self-respect and independence which is not often found in others of a like class. Drink is their besetting sin, and it would seem that the fascinations of their special liquors, such as camphre, petit noir, fil en quatre, casse-poitrine, are not to be withstood. But though a liberty-loving race, these wild men and women of the outskirts are a peace-loving one too, and they are seldom in prison; yet from the beginning of their history they have been subjected to every kind of persecution. As early as 1698 they were forbidden by law to walk the streets before daybreak, and it is only since the Republic that the chiffonniers have been allowed to ply their trade without the once necessary adjuncts of government copper medal, certificate, basket, crochet (pronged stick), and lantern.—Englishwoman.

AN IMPROVED REEL.

The reel shown in the illustration is adapted to facilitate quickly throwing the gearing in or out of action, or retard the revolution of the pulley. It forms the subject of a patent issued to Thomas J. Halleck, of No. 506 West Thirty-ninth Street, New York City. From the plate fastened to the rod projects a pivot on which revolves the metallic hub of the pulley on which the line is reeled, the pulley having in its front face a recess closed by a disk on the forward end of the pivot, and the driving gear being located in the recess. On the

HALLECK'S FISHING REEL.

hub, in the recess, is a pinion engaged by a large gear wheel, whose shaft rotates in bearings on an arm that is adjustable on the front face of the disk, there being a handle on the outer end of the shaft, and the arm, which extends across the outer face of the disk, having at its center a larger recess for the outer end of the central pivot. On the opposite end of the arm is a knob and catch, the knob being connected with a spring disk, and, on lifting the knob, the arm may be pushed to move the bearing of the larger gear wheel, so that its gear will be out of mesh with the pinion on the pulley, the spring disk holding the arm in either position, as it may be placed. When the larger gear wheel is out of mesh with the pinion, the pulley is free to rotate loosely, permitting the line to unreel quickly for casting purposes, but such free rotation may be more or less checked, as desired, by a spring-pressed pawl, which also clicks on the pinion to give an alarm in case of a bite, or to prevent accidental unwinding. There is also a spring brake on the back side of the reel casing, to brake the pulley when casting.

Notable Engineering Achievements in the Great Lake Region.*

BY JOHN BIRKINBINE.

After exhibiting on the screen a map showing the proportions of the lakes as compared with Eastern States, and reference to the fact that three thousand vessels of total capacity of one and a quarter million tons float at elevations practically equivalent to the height of the statue of William Penn on the city hall tower in Philadelphia, the various methods of mining pursued in the region of Lake Superior were discussed. Starting with the preliminary log cabin, the first winch was illustrated, then the shaft, and finally the operating mine. Similarly, instances of the steam shovel and milling system of mining on the Mesabi Range of Minnesota; the deep underground exploitations of the hard iron ore mines of Michigan, and of the copper mines were referred to. A diagram was also presented, showing the great depth to which mining operations have been carried on, and the relation of these to ocean level and to that of Lake Superior. Views of hoisting and pumping machinery, methods of timbering, a timber squeeze, man engine, ore pockets at the mine, etc., were illustrated and referred to, a number of flash light views taken under ground by Prof. Denton, of the University of Minnesota, being part of the display. The docks from which ore is shipped, consisting of several hundred pockets with adjustable spouts, were described, and instances given where 2,500 tons of iron ore were deposited in a boat within forty-five minutes.

The "whale-backs," the steel canal boats, and other forms of vessels in use on the great lakes were discussed, and the facilities which they offer as means of transporting heavy freight referred to. The ore receiving docks on the lower lakes were then described. At these ore is handled from a vessel's hold after the buckets are loaded by stevedores, and conveyed several hundred feet back from the water for a cent or less per ton. The coal docks, both for shipping and receiving coal, and some of the special appliances were noticed.

In the matter of harbor improvements, special attention was given to the artificial entry to the harbor of Duluth and of the new breakwater at Marquette. The latter is a series of "beton" blocks, each about 100 tons in weight, formed in place, but leaving alternate spaces of 10 feet between each block, which was subsequently filled in by similar blocks, this being done to prevent any local settlement disturbing more than one 10 foot section. The enormous shipment through St. Mary ship canal was said to have been 13,000,000 tons in the eight months in which navigation was open in 1894, and it will probably approximate 17,000,000 tons the present year. The statement was also made that the average distance the freight was carried by water was over 800 miles, and the cost slightly less than 1 mill per ton-mile. The growth of this canal was demonstrated by the fact that although in 1856 a lock 350 feet long, 60 feet wide and 12 feet deep was considered ample for a century, by persons then well versed in local progress, in 1880 a new lock, 515 feet long by 80 feet wide and 16 feet deep, was opened, and the congestion was so great in 1894 with this canal that the average detention of vessels was over seven hours. A new lock, 800 by 100 feet and 20 feet deep, is now practically ready for service on the American side, while another lock on the Canadian side, 900 by 60 feet, will help relieve the congestion. These locks are to overcome the difference of level between Lake Superior and Lakes Michigan and Huron.

The Chicago drainage canal was then liberally illustrated, and facts concerning the 40,000,000 cubic yards of material handled were given. Among these was the average cost of rock excavation at 76 cents and dirt 22 to 28 cents per cubic yard. The material was largely handled, after the top lift had been removed, by means of cantilevers, cable-ways or swing derricks, which met with favor in the order named—a cantilever costing, however, about $28,000, while a cable-way cost but about $12,000. Few of the contracting firms owned their conveying apparatus, most of the work being sublet to conveyor companies. Drills which have bored from 90 to 130 feet per day in the limestone rock through which the canal is cut could penetrate but from 6 to 20 feet in the harder Lake Superior iron ores.

The propeller pump used at Milwaukee to flush the river by delivering about 40,000 cubic feet of water per minute was illustrated. The improved methods of constructing vessels for the lake traffic and the unique way of launching them sideways also received attention and illustration.

The railroad tunnel under the St. Clair River was shown in section and the statement made that during the season of navigation a greater tonnage passed through the St. Clair River than elsewhere in this continent.

The paper closed with a reference to the improvements at Niagara, and a statement that the engineering features of Lake Ontario and the canal between Lake Erie and Lake Ontario had necessarily been omitted to make the description complete so far as the upper lakes were concerned, although it was not claimed that all of the remarkable achievements of the engineer had been mentioned.

At the close of Mr. Birkinbine's remarks there was some discussion on the temperature of deep mines, and in answer to a question the statement was made that with fair ventilation it need not be uncomfortably warm. In some mines water found at a depth of about 1,500 feet is quite salt, and at a greater depth becomes acrid. Large masses of pure copper are often mined, sometimes with pure silver attached to them. The Quincy mine was cited as having yielded masses that were cut down to pieces weighing 10 tons so as to be put into the furnace.

* Abstracts from a paper read recently before the Engineers' Club of Philadelphia.

SIXTEEN new steamers of the largest class for passenger and freight business have been contracted for by the owners of the principal lines of steamers plying between New York and European ports.

The Detroit Boiler Explosion.

Without a doubt the most disastrous boiler explosion which has occurred in this country, that is, so far as loss of life is concerned, was that in the Detroit Journal building, on Larned Street, Detroit, Mich., Wednesday, November 6, which reduced the four story building to kindling wood and resulted in the death of thirty-seven people, while many more were badly injured. The following account is given in Lord's Magazine:

The day force had just gone to work at nine o'clock in the morning when the building was seen to swerve and shake, the front and back walls fell outward, and in a few moments what had once been a handsome building was a mass of ruins.

Cries for help and shrieks from the wounded went up from the wreck. The general fire alarm was turned in and ambulances and engines hurried to the scene.

The concussion caused by the explosion was so terrific as to shake every building within several blocks of the Journal office.

Windows were broken and many persons were injured by falling glass. The Calvert building across Shelby Street from the Journal shook like a reed. Nearly every window on the Shelby Street side was blown in, including two heavy plate windows on the second floor.

The building directly opposite the Journal structure on Larned Street, occupied by the Free Press Printing Company, had scarcely a whole light of glass left intact, while the Arcade building, adjoining the Free Press, had the appearance of having gone through a wreck of its own.

The cause of the explosion at this date yet remains a mystery.

After part of the wreckage had been cleared away the rear end of the fatal boiler was found lying near the Larned Street wall. The sheet was torn straight across, just back of the steam dome, three-eighths inch of iron having parted like cardboard and heavy rivets broken as if they were matches. This piece of iron was spread out until almost flat, and was hurled with such force against the cylinder head of the engine that it was crushed and battered as if it were made of glass.

The east boiler did not come out, but was carried off its foundation and through the solid stone wall into the Davis cellar. The force of this blow bent the boiler near the steam dome, parted the seams, and bent the tubes. The crashing of this boiler through the foundation caused the collapse of the two buildings.

The safety valve of the low pressure boiler was found, but so badly broken that the inspectors were unable to tell whether it was in good condition when the explosion occurred or not.

The steam gage was found so badly damaged that no one could tell what pressure was registered at the time of the explosion.

There was not a solid joint left in the building, the west wall being driven out several inches and the east wall badly cracked and thrown several inches out of plumb. In fact, the entire building was moved on its foundation.

The boilers were in charge of Engineer Thomas M. Thompson, who was painfully but not fatally injured. His statement concerning the accident was as follows: He was in the mailing room when the explosion occurred, having left the boiler room ten minutes before. At the time the west boiler showed 65 pounds pressure on the gage and the glass tube indicated two gages of water. There was a low fire under the east boiler, the gages showing 15 pounds pressure and three gages water.

The boilers were licensed to carry 90 pounds of steam, the safety valves being set at 80. The boilers were plain tubular, 5 feet in diameter, 14 feet long, with 3 inch flues, and built by Stephen Pratt in 1884.

They were connected by a 5 inch main, from which ran the main steam pipe to the engine, with 3½ inch branch to the elevator pump. Smaller pipe connections conveyed steam to the heaters in the various rooms in the building.

The boilers were fired by oil, the supply being carried in two tanks with a joint capacity of 55 barrels. They were coupled with a T, from which 2½ inch pipes conveyed the oil to the burners beneath the boilers.

Mr. Thompson states that about two weeks before the explosion the blowing out of a manhole gasket caused him to place the east boiler in service until repairs on the west could be made. The west boiler was fired up the day before the accident and found all right, the engineer noting that the safety valve blew at the stated pressure.

He further said that one of the blow-off valves leaked, and Tuesday evening, when he shut down, he started the injectors and gave the boilers over three gages of water in order to have enough to start with in the morning.

On coming down the morning of the explosion the glass showed that about one inch of water had leaked out during the night. In this connection the engineer states a fact that may be an explanation of the cause of the accident.

There had been such a demand for steam that one boiler was not sufficient, and after he had thrown the west boiler into service, he fired the second furnace, with the intention of coupling them as soon as the gage on the east boiler should show 60 pounds of steam. As stated before, this boiler only showed 15 pounds when he left the room, and had not been coupled.

There is a possibility that the leaking valve had allowed nearly all the water from this boiler to escape during the night.

Mr. Thompson had just entered the mailing room when the accident occurred. He was hurled against a wall surrounded by clouds of steam. Near him was a chute leading down to the press room, down which he slid. Here he was found later by the members of the fire department and taken out through a window.

Mr. Thompson says that it has been his custom to blow off steam through his glass gages once a week in order to be sure they are not clogged. He is positive that he tried the water cocks the morning of the accident. He further stated that the oil gage showed about twenty-five barrels in the tank.

W. H. Wells, of the firm of Wells, Angell & Boynton, attorneys for the Newbury estate, which owned the building, says that Engineer Thompson was a thoroughly competent engineer and machinist, strictly temperate, and an associate member of the Y. M. C. A.

In October, he entered the classes in algebra and mechanical drawing at the night school of the association, and it is hardly likely that a man who at his age has strong character enough to study nights would become careless at his work.

As is usually the case, the engineer comes in for a large share of the blame for the casualty, and the grand jury have indicted him for manslaughter.

Tests of the boiler plate which are in progress may throw new light upon the case, but should the decision show that the cause was from low water, it, of course, will have to be laid at Engineer Thompson's door.

The public at large fails to realize how little stands between safety and danger in a boiler plant. The apparatus which has furnished heat and power for years without an accident is never noted, and the engineer is considered as an unskilled laborer to a great extent, or one whose duties consist of starting and stopping an engine or shoveling coal into a furnace; but, let an accident occur, and all this is changed. The engineer always comes in for censure until he is proved not guilty, and, as in the present case, is indicted for manslaughter. His character and habits are closely inquired into, and his ability—the first time that has been considered—is investigated.

In fact, then, and not till then, do the public for a moment think that the engineer should have been possessed of anything like ability which would carry him above the plane of an unskilled laborer.

It is to be hoped that some developments may come out of the investigations which will prove that the responsibility for the terrible catastrophe does not rest upon Engineer Thompson, and that all judgment will be suspended until the thorough investigation which is in progress shall have been completed.

Accident on the St. Paul.

A serious accident took place on the American line steamer St. Paul, at her pier in New York, on December 18, in which nine men lost their lives and several others were severely injured. The fatality was caused by the fracturing of the main starboard supply pipe just as the machinery was being started to test it before sailing. No definite statement of the cause of the accident will be made until a thorough investigation, which the company is now conducting, is completed. The explosion occurred about seven in the morning. The noise brought the officers and crew to the engine room. The steam was at once shut off and the work of rescue began. All of the men in the engine room were killed and all except two of the fifteen men in the boiler room and electrical compartment were badly injured. The pipe, which was 15 inches in diameter, snapped off at the elbow. The steam pressure was less than usually carried, being only 130 pounds.

Similar accidents have occurred on vessels of both the English and American navies. Two accidents of the same kind have occurred in stationary plants in New York City within a month. On November 26, the elbow in a pipe which supplied steam to the engine which runs a lighting dynamo in Hammerstein's new music hall, called the Olympia, blew out, resulting in the death of two men and the injury of several others. The main steam pipe is 10 inches in diameter. From this a 6 inch feeder runs to the engine, and fastened to this 6 inch pipe was the elbow which blew out.

It is suggested that the accident may have been due to a too rigid connection, causing the elbow to burst by the expansion of steam, or to the presence of cold water in the pipe, or to a defect in the elbow, which, it is said, appeared to be about one-sixteenth of an inch less in thickness in one place than in another.

On December 19 a steam pipe leading into the generator of a stationary engine in the Consolidated Gas Company's works at the foot of East Twenty-Second Street exploded, killing one man and injuring several others.

These sad examples show that steam supply pipes, as at present constructed, need improvement, and we trust that the subject will be carefully studied by inventors.

To Make Cloth Waterproof, but not Airproof.

To the query how can I waterproof a cloth without making it airproof at the same time? the following reply is given:

To make a cloth waterproof, but not airproof, is a demand that is difficult, if not impossible, to comply with. Let us simply imagine what is necessary, and we have: 1. The spaces between the threads must be filled; and 2. The sponge like condition of the textile fibers, by the force of which they absorb both air and water, must be neutralized. It is evident that the inlets for water cannot be closed without at the same time affecting in like manner the passage of air. It is true that air is finer than water, and the question could doubtless be answered, if figuratively speaking, such a treatment of the cloth were possible that the doors were barred against the entrance of the coarser fluid and the finer element were allowed to squeeze through.

By studying this question, we would come to the conclusion that such a thing might be possible, if we understood how to neutralize the spongy condition of the textile fibers referred to without having recourse to filling the interstices between the threads. As water passes through a cloth essentially because of the absorptive capacity of the latter, it would be necessary to annihilate this property of the fibers in order to effect the desired purpose. The way to do this is plain, and that is to impregnate the threads before weaving, but as this cannot be done for a number of reasons, the treatment of the ready cloth is the next recourse.

Several formulas for effecting this have recently been patented, and in one of them James G. Smith dissolves gutta percha and India rubber in paraffin. The latter melts between 122° and 165° Fah., and when heated to 212° or 230° Fah., it dissolves 100 per cent of its weight of gutta percha or India rubber. Upon this fact is based its adaptability for waterproofing cloths, but not airproofing them; 15 parts gutta percha or India rubber are to be dissolved in 100 parts paraffin and the solution, at a temperature of 158° Fah., is applied direct to the cloth to be impregnated, or what is still better, the solution is dissolved either with benzine or benzol, and the cloth is then drawn cold through this diluted solution until thoroughly saturated, any excess being removed with a current of air or else in a suitable manner by steaming.

Similar to the above method is one of Napoleon Lefebvre and Edmond Aron, who propose a fluid 1,000 parts of which contain 987 benzine or sulphide of carbon, 3 parts India rubber, and 10 parts paraffin.

François Joseph Pescuard and A. P. E. Tardieu make a cloth waterproof without at the same time excluding air, which is necessary to carry off the perspiration from the body, by the use of the following fluid: 55 grammes India rubber, 2 grammes gutta percha, 800 grammes benzine, 25 grammes sulphide of carbon, 10 grammes essence of turpentine (terrebinthe), 200 grammes ordinary linseed oil, 70 grammes boiled linseed oil, and, according to circumstances, a little black or white (charcoal or zinc white).

It is said that the first formula is adapted in every respect for the object in view.—Industrial Record.

New Variable Star of the Algol Type.

Dr. Edward C. Pickering reports in Harvard College Observatory Circular No. 3 that the star B. D. + 17° 4367, magn. 9.1, whose approximate position for 1900 is in R. A. 20h. 33·1m., Dec. + 17° 56′, appears to be a variable star of the Algol type. On July 18, 1895, Miss Louisa D. Wells found that no trace of this star appeared on the photograph I 4359, taken with the 8-inch Draper telescope on September 26, 1891, exposure 16 m. On 71 other plates taken from June 30, 1890, to October 5, 1895, the star appears of its normal brightness. On December 12, 1895, at 10h. 42m., Greenwich mean time, Prof. Arthur Searle, who had watched this star on several nights, found it more than a magnitude fainter than usual. During the next half hour it diminished about half a magnitude more. Meanwhile, a photograph taken with the 8-inch Draper telescope, I 14036, confirmed the diminution in light.

Gas Engine Economy.

It is stated that the electric railroad at Lausanne is operated from a power house in which the dynamos are driven by two gas engines of 130 horse power each, built by Crossley Brothers, in England. They use a gas which is made in producers in the power house. The dynamos are run by belt. The working is said to be very economical, and the best result obtained has been an expenditure of 550 grammes of anthracite coal per horse power hour in ordinary service. The engines are run on an average 18 to 20 hours per day. A careful calculation has shown that the amount of fuel used is 1,300 grammes of anthracite per car kilometer.

CLOSE OF THE ATLANTA EXPOSITION.

At the extreme left, in our illustration, is shown the New York State building, to the right of which is the Fine Arts building, with a frontage of 245 feet, and exterior of classical design. Still further to the right is the 150 foot high tower, with its chime of large bells, which has formed a notable feature, while at the extreme right of the picture, partially hidden by the foliage, is the United States Government building.

During the fourteen weeks of its continuance, the great Cotton States and International Exposition, which closes officially on December 31, has afforded a luminous record of the versatile industrial and educational advancement of the South during the past quarter of a century, and constitutes a fitting memorial of the energy, enterprise and liberality which now dominate throughout the entire cotton belt, no less than in other sections of the country.

That it has, in its wide scope, attracted such large numbers of exhibitors in all departments of art and manufacture, and such crowds of visitors from all sections of the country, are but evidences of the general recognition of the great importance of that new and vigorous industrial life which has but recently brought portions of the South into competition with New England and Pennsylvania. The work of the Exposition, in part educational and in part to promote commercial intercourse and enlarged exchanges of commodities, has been well done. It was conceived on a broad and generous plan, in which expense was not spared, and the experiences of previous expositions were wisely utilized. The Exposition park comprised a tract of 189 acres, the ground being most picturesquely located within two miles of the center of the city of Atlanta.

During the continuance of the fair the various railroads centering in Atlanta, well representing the entire railway systems of the country, made great reductions in their rates, with the result that the attendance was liberal from remote as well as from near-by points. This was particularly the case on the days especially devoted to different cities, representative delegations from Chicago, Philadelphia, New York, Brooklyn, Boston and many other cities making the days set apart for such local commemoration memorable as among the most interesting and exciting in the history of the fair.

Increase of Naval Engineering Efficiency.

Senator Watson C. Squire has introduced a bill (S. 735) to reorganize and increase the efficiency of the personnel of the navy, to increase the usefulness and numbers of the corps of naval engineers, to induce the scientific institutions to provide a naval engineering reserve for time of war, to establish a naval engineering experimental station and to encourage the study of the mechanic arts and sciences, and particularly that of naval engineering, in the technological colleges of the country.

In the course of his remarks he said :

"I recently visited the flagship Philadelphia, and had great satisfaction in examining that splendid cruiser. Going through the vessel below the water line, I observed the vast amount of machinery, the complicated elements that enter into its construction, making the care of a modern vessel of war very important as regards the feature of steam engineering. One passes through compartment after compartment, and is almost lost in bewilderment in the mazes of the complicated machinery around him. It occurred to me that not enough attention has been paid to the personnel of the navy as respects steam engineering. Truly the propelling power is the soul of the ship. Without it the ship cannot be handled and is totally useless. This power is under the supervision of the engineer officers. Therefore it is needful to have a high order of personnel, a larger number of officers, and those of great attainments and proficiency.

"We are building in this country vessels that were unknown to former times, and we need adepts in the art of engineering and marine architecture. There is no way to obtain a suitable class of men except by preparing them in the various educational schools. Ships can be built, but men cannot be built. When war comes, if it should come, unhappily, we will need proper men to handle these great engines of war. The only way to have such men is to educate them in advance. I believe the provisions of the law of 1879 should be carried out, and that the schools and colleges of the land which apply for professors of steam engineering and naval architecture should be accommodated by the detail of officers for such purpose. But that is only one of the features which contribute to the practical merit of this measure.

"It is evident, too, that there is great danger of the breaking down of those officers. They are employed in very difficult work. To take care of all this valuable property requires a high degree of skill, and causes an immense strain upon the officers. It is well known that our battle ships cost about $4,000,000 apiece, and they are liable to have something out of order all the time. In fact, one of the officers of this corps told me that there is usually something out of order on a war vessel all the time requiring the attention of an expert. Oftentimes those officers have to submit to very severe physical strains. They have to go down and work in the hold of the ship, where the temperature ranges from 150 degrees to 170 degrees Fahrenheit, and this causes great physical exhaustion. I believe that the number of engineer officers should be increased so as to make provision for these breakdowns, and to enable a sufficient number of officers to be employed on vessels to allow for necessary changes in the supervisory watch. This branch of the service of the navy should be encouraged and dignified and rendered more attractive and popular to the cadets and those naturally fitted to become engineers, and for this and other reasons, that the officers should be given positive rank and title, so that a mere officer of the deck, perhaps an ensign, cannot control a commodore in the Bureau of Engineering, unless such officer shall be in command of the ship. I think, too, that the manner of selecting cadets and filling vacancies in the Engineer Corps should be changed so that Senators shall have the appointment of such cadets. Something must be done or the personnel of the engineering force in the navy will fall far below the proper standard. In fact, it may be considered relatively below it to-day, as shown by th report of the naval committee in 1892.

"We have in commission in the navy at this time forty-two vessels, with nineteen more vessels building, making in all sixty-one. It is useless to undertake to manage this vast interest without having competent men, thoroughly educated and prepared, and a sufficient number of them to provide for the necessary changes."

THE ATLANTA EXPOSITION—VIEW LOOKING NORTH FROM THE PLAZA.

AN inch of rain falling upon an area of one square mile is equivalent to nearly 17,500,000 gallons, weighing 145,250,000 pounds, or 64,844 tons.

THE CABLE REPAIR STEAMER MACKAY-BENNETT.

The present is peculiarly a scientific age, rife with great enterprises which have originated within the memory of most people. It is not a great many years ago when the completion of the first ocean telegraph was celebrated with great pomp and enthusiasm. Transoceanic telegraphy is distinctively a modern institution; as such it is necessarily controlled by modern methods.

One of the great companies, the Commercial Cable Company, owns and operates three complete submarine lines between Europe and the United States. To keep these cables in order this enterprising company has a fine steamer, the Mackay-Bennett, which was built especially for the purpose by John Elder & Company, at Govan-on-the-Clyde, at a cost of $320,000. She is 260 feet long, 40 feet beam, and 22 feet deep, and is propelled by twin screws driven by independent compound engines, each having a high pressure cylinder 15 inches in diameter and a low pressure cylinder 25 inches in diameter, the stroke being 3 feet. The combined horse power of the engines is 1,500. The gross tonnage of the vessel is 1,700 and the coal capacity is 750 tons. Her speed is 12 knots per hour.

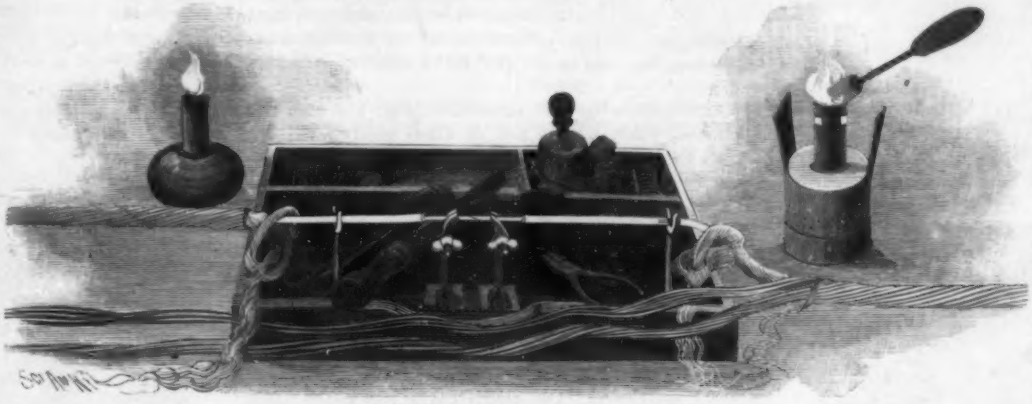


Fig. 2.—SOLDERING THE SPLICE.

The Mackay-Bennett is provided with three cable-holding tanks with a total capacity of 385 nautical miles; tank 1 holding 60 miles; 2, 195 miles; and 3, 130 miles. The central cores around which the cable is coiled are utilized as fresh water tanks. The steamer is fitted up with all the modern machinery for grappling, picking up and paying out cable. It is lighted throughout by electricity and is furnished with electric search lights, so that work can be carried on during the night. The steering is done by steam, and the necessary steadiness is secured by bilge keels. The vessel is provided with a bow rudder, so that it can steam astern. The maneuvering qualities are excellent. A staunch steam launch is provided, which is much used in work near the shore.

On the deck are placed two powerful engines for heaving in and paying out the cable. At the bow and stern are placed immense sheaves, as shown in our engravings, over which the cables pass when delivered or received. The engines for handling the cable are geared to drums 6 feet in diameter, 2 feet in width, each being mounted on a shaft 11 inches in diameter. The cable, which is wound several times around this drum, passes over quadrants or guides at the hatches. If it is being taken up, it is coiled around the core in the tank below, as shown in the large engraving. In this case it requires a powerful engine to bring it up from the depths of the ocean, but where the cable is paid out, it simply passes over the drum, which is then detached from the engines, and the paying out is controlled by a brake operated by the man on the platform. The cable in its passage to the bow or stern of the steamer goes under the sheave of the dynamometer, which indicates the amount of tension on the cable. The strain on the cable usually ranges from two to three tons.

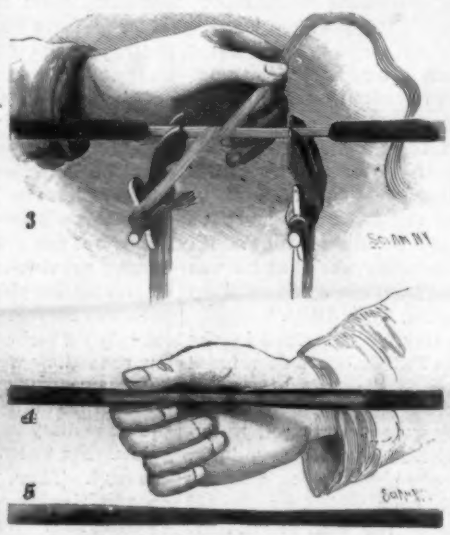


Fig. 3.—WRAPPING AND COVERING.

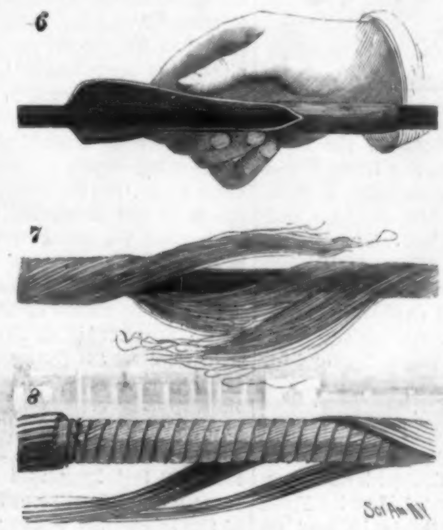


Fig. 4.

On the upper deck at the bow and stern are electrical signals, by means of which the engineer in charge of the ship's engine and also the engineer in charge of the cable handling engines may be notified to stop, start, or go ahead or astern, fast or slow, as circumstances may require. Attached to the shaft of the drum is an indicator which shows the number of miles of cable paid out or taken in. On the deck of the steamer are guides which lead to the different tanks. The cable may be drawn from either of the three tanks by either of the cable handling engines. Upon the deck are carried buoys, which are launched and to which the cable is secured when it is desired to detach the cable from the steamer, and leave it to be subsequently picked up and extended. The cable tanks are watertight, and the cable is kept in water, and while the laying of a cable is going on, electrical tests are progressing continuously, so that any defect may be detected and remedied before the cable reaches its final resting place upon the ocean bottom. The electrical testing room has a very complete electrical equipment, and the electrician is always in attendance to discover and locate any faults.

To one not familiar with the characteristics of the electric current, it seems a difficult matter to locate a fault in an ocean cable hundreds of miles at sea, but a competent electrician can generally locate the fault within a few miles. The insulation of the conductor must be maintained in a very perfect condition; otherwise the cable is rendered useless. A puncture in the insulation of the diameter of a hair is sufficient to interfere with the proper working of the cable, and to necessitate the journey of the repair steamer to the point where such an apparently insignificant thing exists. On reaching the vicinity of the fault the grapnels are thrown out and the cable lifted to the steamer, when it is taken on board and dissected and repaired, the defective section being removed and replaced by a perfect piece of cable. The manner in which the cable is spliced is illustrated in Fig. 2. After the defective portion is cut out, the ends of the cable adjoining the splice are unwound, and the copper conductor at the center is laid bare. The ends of the copper conductor are scarfed and lapped, as shown; then the joint is secured by soft solder, after which a spiral wrapping of fine copper wire is laid over the joint, as shown at 3 in Fig. 3, four or five fine wires being laid on parallel with each other, forming a spiral wrapping of considerable pitch. Upon the first layer of fine wires another layer is placed which is wound in the opposite direction, thereby causing the wires to cross each other. These wires are soldered smoothly, the interstices being completely filled with the solder, and while the conductor still retains the heat acquired in soldering the gutta percha covering is worked over the joint, as shown at 4 in Fig. 3, the splice having been previously coated with a cement to insure the perfect adhesion of the gutta percha to the metal. The appearance of the cable core after the completion of this step in the process is shown at 5 in Fig. 3. A wrapping of gutta percha is now placed on the joint, as shown at 6 in Fig. 4, this part of the work being done with the greatest of care to avoid the slightest possible air space communicating with the conductor. The gutta percha covered conductor is served with marline (7, Fig. 4), and this is wrapped with fine twine, as shown at 8 in Fig. 4, and last of all the wire armor is replaced. The total length of the splice is from 40 to 80 feet. The operation of splicing the armor is practically the same as that of splicing any wire cable. The splice thus made is stronger than the cable and its electrical conductivity is also greater than that of other parts of the cable. The Mackay-Bennett can lay cable at the rate of 6 to 8 miles per hour.

It is obvious that in laying cable it is necessary to know something of the character of the ocean bottom. It is especially desirable to avoid shallow places. The steamer is provided with the James "sentry and sounding machine," which

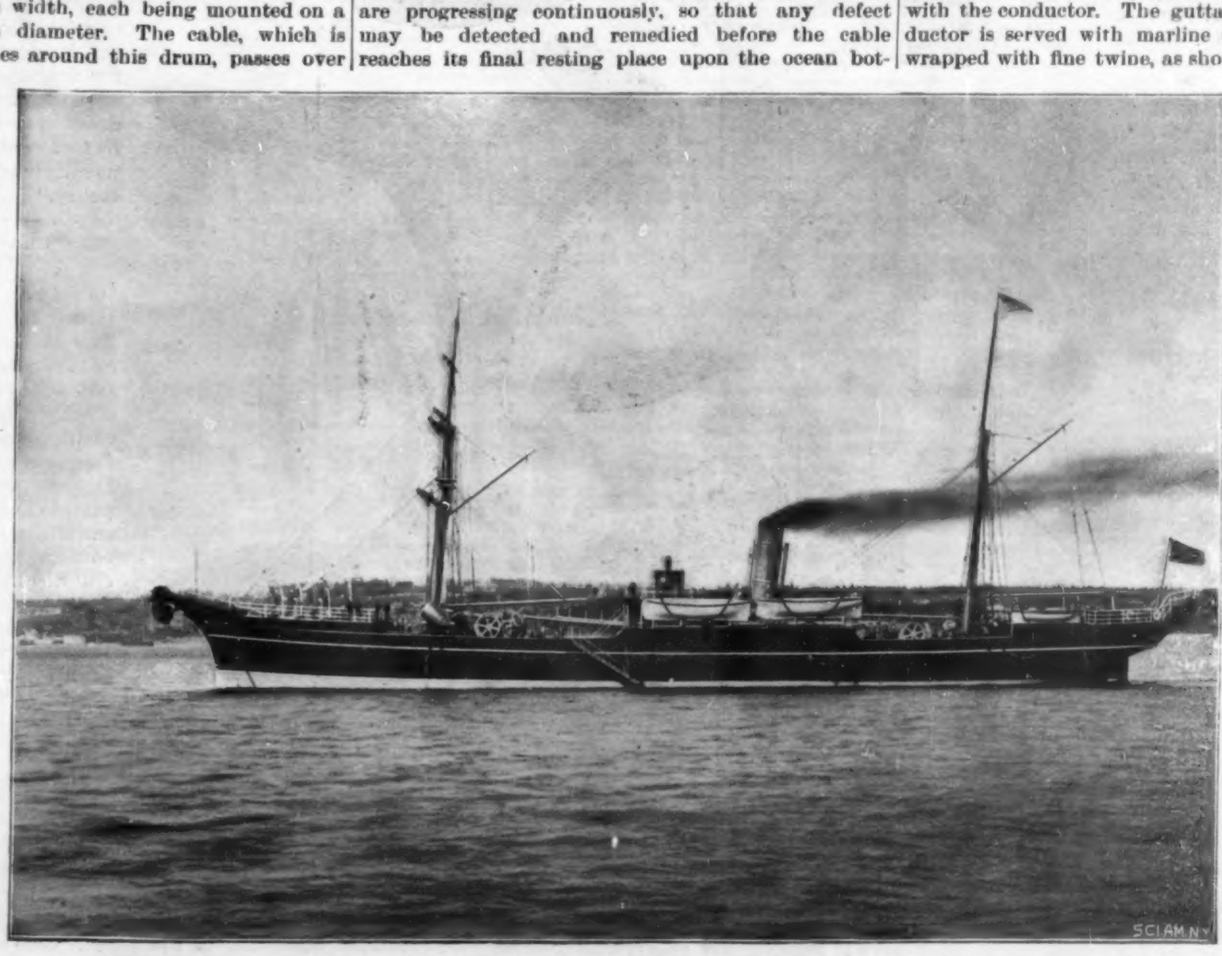


Fig. 7.—THE COMMERCIAL CABLE COMPANY'S REPAIRING STEAMER THE MACKAY-BENNETT.

gives notice on board of the approach to shoal waters. A device called a "kite," shown in Fig. 6, is trailed behind the steamer, as shown in Fig. 5, being attached to the end of a piano wire wound upon the drum of the sounding machine. The kite is attached to the wire in such a manner that it dives under the stern of the boat to the minimum depth.

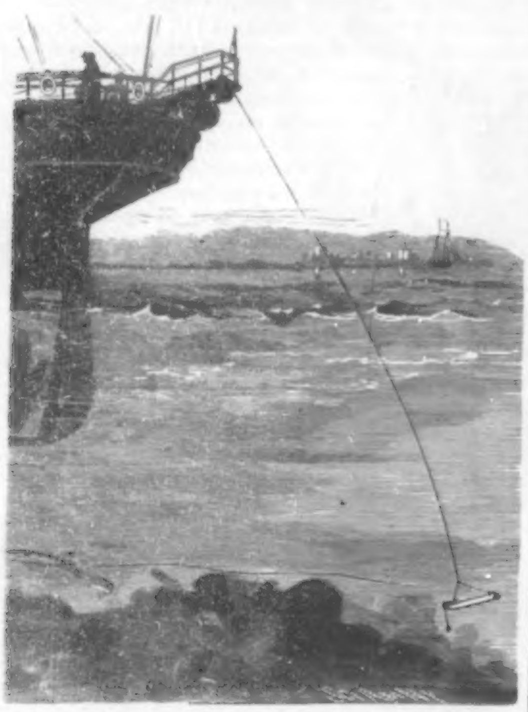


Fig. 5.—JAMES SENTRY AND SOUNDING MACHINE.

Should the steamer enter shallow water, the lever at the lower end of the kite strikes the bottom and releases the front end of the kite so that it trails behind the steamer at or near the surface and offers less resistance at the machine. The diminished pull causes a bell to ring on the sounding machine and another on the bridge. The sounding machine is adjustable for different depths. On the deck at suitable places are placed electric signaling machines, made by Eliott Brothers, of London, for communicating with the engineer of the paying-out machines and with the ship's engineer.

The Mackay-Bennett came on from Halifax in September last to lay cable for reporting the yacht race. The shore end of the cable was dropped at Coney Island at a point east of the Oriental Hotel. From this point it was laid out to the lightship, and an extra mile was run out in great coils to enable the ship to change her position if necessary. By the use of this cable, reports of the movements of the yachts were instantly transmitted to New York City, so that the progress of the race was better known to observers of the bulletins than to most of the actual spectators. Through the courtesy of Captain E. G. Schenk, Chief Officer W. F. Linton, Engineer J. W. Burn, and Electrician C. Priest, we were enabled to thoroughly inspect everything on board the steamer.

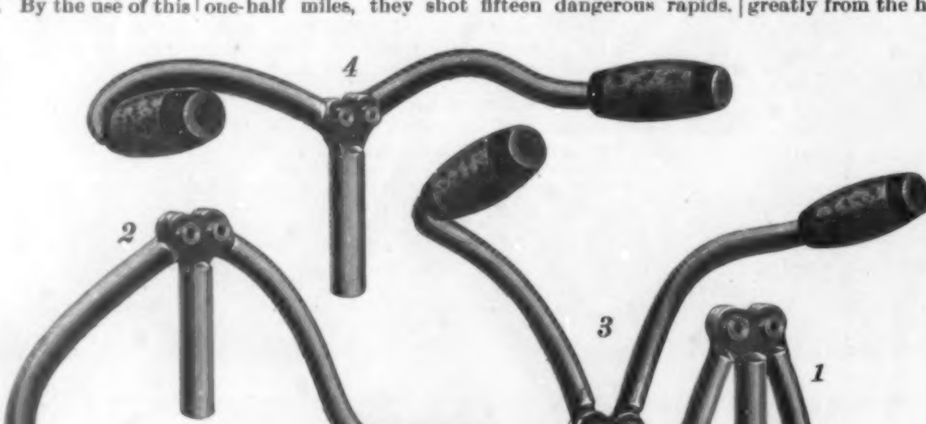
THE LOVELL ADJUSTABLE HANDLE BAR FOR BICYCLES.

The subject of adjustable handle bars for bicycles has received much attention during the past season. We illustrate in our present issue a new system of adjustment, which seems to possess all the desirable requisites while avoiding the difficulties which have been encountered in other ones put upon the market. In the upper part of the tube or handle bar stem is a double swivel joint, which receives the ends of the two handle bars, they being secured by bolts passing through them. The handle bars terminate in lugs, which fit within the swivel joints and which lugs are on their inner periphery provided with teeth. When the handle bars are in position, these teeth mesh into each other. This makes the movements of the bars interdependent. If one bar is raised, the other one rises with it, if depressed, the other one is depressed; hence the handles are always on the same level. Another feature about the bar is, that the inclination of the handles is invariable. In the usual type of handle bar when swung up or down the inclination of the handles varies so that in the upper and lower positions they are very uncomfortable, the inclination being only correct in one position. In the Lovell bar the inclination is always correct—one of the minor advantages of this bar applied in the storage of a bicycle when it is kept in the hallway of a house or other restricted space. This especially applies to shipment on trains, and when crated they can be shipped with bars in place, but dropped, there being no loose and attached handle bars to be tied on or otherwise disposed of.

The cuts show the bar in detail. Fig. 1 shows the handle bar when not in use or when ready for shipping on the wheel. Fig. 2 shows the mode of adjustment. Fig. 3 shows the bar inverted to its full height. Fig. 4 shows the bar about where it would be used by the average rider. Fig. 5 shows it as in use by a fast rider or racer.

As can be seen from Figs. 1 and 2, the handle bar can be adjusted to any position desired, so that the rider can have his handle bar adjusted to where it suits him best. This adjustment does not in any way change the position of the grips, and is the only one of its kind on the market which gives any adjustment and at the same time leaves the grips in a comfortable or natural position.

The manufacturers are the J. P. Lovell Arms Company, Boston, Mass.



THE LOVELL ADJUSTABLE HANDLE BAR FOR BICYCLES.

Exploring the Colorado River.

The San Francisco Call says: 2d Lieut. F. M. Davis, 4th Cavalry, who accompanied 1st Lieut. C. L. Potter, of the Engineers, in his late expedition down the Colorado River, is busily engaged on his official report of the undertaking. Although the report is primarily prepared for official eyes, it will be no ordinary compilation of technical information and forbidding statistics. On the contrary, the report will record one of the most thrilling experiences which human beings ever survived. Speaking of their adventures, Lieut. Davis said recently: "Some time near the 1st of October Lieut. Potter received orders to proceed to investigate the possibilities of the Colorado River for navigation purposes, from the mouth of the Virgin River to Yuma. The understanding was that he was to proceed to the Needles and from there be towed up the river, a distance of 250 miles, by Indians."

The adventures of the party, as described in the Call, were very thrilling. As Indian boatmen refused to brave the cruel rapids of the treacherous river, two old trappers were hired, who, for $5 a day, were willing to undertake the risk. They were experienced watermen and cool headed. They had bow and stern lines, each 200 feet long, and at one point had to send the men up on cliffs 100 feet high, from which, by the aid of the lines, they would "snub" the boat around the ledges of the canyon walls. In one day, within six and one-half miles, they shot fifteen dangerous rapids. Before them seemed almost certain destruction, and to turn back was impossible. The further they went the deeper and blacker became the canyon. Concerning rapid No. 26, Lieut. Smith says:

"Here on both sides towered the steep black walls, 1,000 feet high. Between these walls for a mile there was nothing but angry, hissing foam. We examined first one side and then the other for ledges along which we might climb and draw the boat. It was useless, and to attempt to run that frightful place would have been madness. It was at this point that Major Powell's men abandoned him. We searched for the trail by which they escaped from the prison-like inclosure, but in vain. In our explorations I had sprained my ankle, and we were compelled to lie over a couple of days until I could walk. In the meantime Lieut. Potter investigated several branch canyons in the hope of finding a means of egress. On the Arizona side he followed a canyon for eight miles, to where it abruptly ended in a perpendicular wall 4,000 feet high.

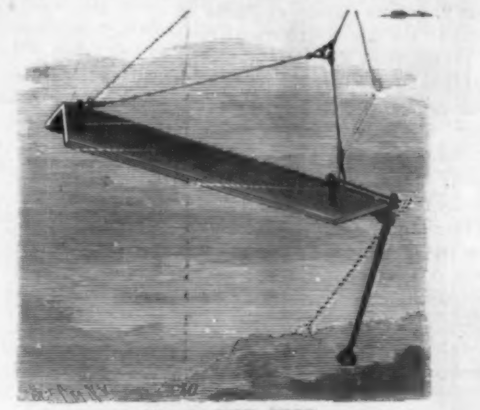


Fig. 6.—THE KITE.

He followed a canyon on the Colorado side fifteen miles with a similar result. At last we determined to take desperate chances. Taking all our provisions and outfit from the boat, we prepared to attempt to follow a faint bighorn trail for a few miles. Lieut. Potter and the rest of the party went on ahead, while I stayed with the boat. The plan was to turn the boat loose and let it shoot the rapids empty and unguided. Lieut. Potter and his party would attempt to catch it as it went by. I waited half a day, and in that time the lieutenant had reached the river three miles further on. Then I turned the boat loose, and in ten minutes it shot by them like a race horse. That left us but one alternative, to follow the bighorn trail. Taking provisions, a blanket each, and our firearms, we started on this perilous journey. Sometimes our path was 100 feet wide, sometimes for 100 feet we had scarcely six inches to cling to. In the latter situation our sensations were horrible. Over 1,000 feet below us yawned the black chasm; beneath us the rock was treacherous and slippery. It was always level, always the same dizzy height from the white, brawling stream below. For twenty-two miles we followed this dangerous trail. Then, with feelings of joy, we emerged upon the Hualapais Desert. We were three days in crossing this. We had plenty of water and provisions, but the men's shoes had given out and they suffered greatly from the hot sand and the cacti. On the third day we reached the Union Pacific Railroad and were taken up. We then proceeded to the Needles and completed the trip as originally contemplated without incident. We found that the river could not be navigated advantageously by any vessel drawing more than two or three feet of water without the expenditure of an immense sum of money."

The Under-running Trolley Patent.

Judge Townsend, of the United States Circuit Court at New Haven, Conn., on the 7th inst., rendered a decision in the suit of the Thomson-Houston Electric Company vs. the Winchester Avenue Railroad Company, declaring one of the Van Depoele under-running trolley patents in suit to be invalid and sustaining the other. These patents are controlled by the General Electric Company.

The patents upon which suit was brought are Nos. 495,383 and 495,443, both bearing date of April 11, 1893. The broad character of the patent No. 495,443 is illustrated by the 6th claim, which is as follows:

6. In an electric railway, the combination with a suitable track and a supply conductor suspended above the track of a car provided with a swinging arm carrying a contact device in its outer extremity and means for imparting upward pressure to the outer portion of the arm and contact, to hold the latter in continuous working relation with the under side of the supply conductor, substantially as described.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ENGINE.—William F. and Eugene W. Cleveland, Rounthwaite, Manitoba, Canada. This is an engine of simple construction, designed to afford a higher than usual degree of efficiency by reducing to a minimum back pressure in the cylinder. It has a main and a supplementary exhaust pipe, the ends of the pipes being alongside each other, and the upper end of the main pipe extending above the upper end of the supplementary pipe, and creating suction over the latter, removing atmospheric pressure and securing a more prompt and perfect exhaust.

CONSTRUCTING SEWERS, SUBWAYS, ETC.—Harry P. McDonald, Louisville, Ky. This inventor provides an apparatus comprising a pair of telescopic shells, the rear one having an annular shoulder pressing against the line of the conduit, the sections being independently or simultaneously forced forward or in opposite directions. Means are provided for temporarily sheathing and applying a permanent cement lining, peculiarly arranged plunger or feed devices setting the sheathing and compressing the concrete as the sheathing and cutter carrying means are forced forward. A carrying mechanism is provided for removing the loose earth and bringing into position the concrete for lining.

GENERATING AND APPLYING VAPORS.—Oreon S. Rhodes, East Stroudsburg, Pa. This improvement is for the generation of vapors of volatile liquids and driving motors thereby, the boiler fluid being preferably a fixed oil boiling at a high temperature, giving great heat without corresponding pressure, and the vapor being generated from a volatile liquid combined with a soluble gas, a volatile liquid, or a liquefied gas. The boiler and engine form but one machine, both making use of the same boiler fluid, the construction being such that the fuel is utilized to the greatest advantage and the danger from explosion is reduced to a minimum.

Electrical.

ANTISPARKLE COMMUTATOR COMPOUND.—John R. Davis, New Iberia, La. To prevent sparkling at the commutator of a dynamo, this inventor provides, for application on the commutator, a compound containing a fatty substance mixed with a good conductor of electricity, the mixture being hardened by chalk. The compound is designed to reduce the wear of both the commutator and the brushes, while preserving a uniformly good contact, so as to obtain a steady flow of electricity.

Mechanical.

WRENCH.—Matthew C. Gay and Joseph Heard, Arcadia, Fla. According to this improvement a fixed head and hinged jaw are detachably connected, so jaws for pipes or for nuts may be interchangeably used, the connection being so effected that the pivot portions of the hinged jaw are guided and slip longitudinally into their seats, moving with such seats in the tilting movements of the jaw. In one tool is thus afforded a pipe wrench and a nut wrench, the device being also simple, inexpensive and durable.

TACK MACHINE.—Russell Hathaway, Elbridge G. Paull, and Cyrus D. Hunt, Fairhaven, Mass. This machine has two cams operating two levers carrying the leader and lazy knives, the cams actuating the leader knife and maintaining the lazy knife up and still while the edge of the plate is turning down, the improvements consisting principally in the form of the lazy cam, the form of the gripping cam, and the centering of the gripping lever. The machine is designed to be run at a high speed with good feeding of the plate, the following of its cam by the gripping lever, and diminution of the wear of the leader knife.

Agricultural.

SICKLE BAR.—James Smith, Granite Canon, Wyoming. This invention provides for a construction of the cutter or sickle bar to materially lighten the draught in mowing grass and harvesting grain, the bar being so made that it may be used for trimming edges as well as for cutting grass. The bar has a series of overlapping disk cutters and means for rotating adjacent cutters in opposite directions and reversing the direction of rotation, each of the alternate cutters being adapted to co-operate with either of the cutters between which it is located.

PLANTER.—John W. Shore, Angola, Ind. This machine is adapted to plant two kinds of seed alternately if desired, the seed being delivered to a chute to conduct it to the ground, and the planting being uniform as to distances apart and the number of seeds or grains delivered at a time. The shoe carrying the chute makes the furrow and covers the seed, and also allows for the vertical adjustment of the chute, springs holding the shoe in yielding contact with the ground.

STAKE FOR PLANTS, FLOWERS OR TREES.—Theron N. Parker, Quick, Iowa. This is an improvement in devices for tagging plants, trees, etc., by florists, nurserymen and others. This stake has a number of wire legs whose upper ends are twisted together, one of the lengths of wire extending up above the others and being bent at its upper end to encircle the stalk of the plant. A sheet metal tag is attached by wire to the top bend.

Miscellaneous.

PHOTO-MECHANICAL PRINTING.—Edouard G. D. Deville, Ottawa, Canada. To change the continuous tones of an original into tones formed of black and white dots by a screen placed in front of the photographic plate, this inventor has devised a new kind of screen, furnished with alternate opaque and transparent squares, disposed like the squares of a chess board.

ADJUSTING BEAT OF CLOCK PENDULUMS.—Fred. F. Richey, Topeka, Kansas. This is a leveling attachment for a clock mechanism controlling the pendulum and verge to such an extent that it will act properly even though the clock should be considerably out of plumb. The device consists of a weighted swinging frame of a novel character arranged to carry the verge, and is applicable to any form of clock mechanism. It is simple, durable, and inexpensive.

VACUUM PAN.—Alphonse F. Gaiennie, La Fourche, La. This invention provides an improved separator for use on evaporators to save liquid carried by the vapors, and for use in separating oil and grease from exhaust steam. The improvement consists principally in the placing of one or more cone-shaped plates in the path of the vapors, within a suitable casing, there being a receiving receptacle at the lower edge of each plate into which pass the liquids separated from the vapors striking the plates, such liquids being returned to the mass boiling in the evaporator.

CHOCOLATE DIPPERS.—Cyprien Gousset, New York City. Two patents have been granted this inventor, one of which is for an appliance for dipping stick chocolate and other elongated forms of candy. It comprises a frame with cross wires formed into loops and transverse brace wires, forming a simple and inexpensive device which may be made to fit odd shapes and hold the sticks so that they may be readily dipped into a chocolate solution, the device holding a comparatively large quantity of candy. In the other dipper, comprising a frame with cross wires and series of rings, provision is made for securing and dipping a large quantity of creams at a time, the creams being so held that practically their entire surface is exposed while being dipped.

CLAMP FILING DEVICE.—Edward W. Farnham, Chicago, Ill. (C., B. & Q. R.R.) This is a file holder and binder in which the files are stacked on a tray provided with cord clamping devices, there being an independent cover with cord for winding around the holder, and one of the ends of the cord being removably secured in the clamping devices, which, with the cord, furnish a guide to retain the files in place. The device is a very simple and inexpensive one to facilitate compact and secure filing, and large orders for it have been placed by the railroad offices in Chicago.

MATTRESS HOLDER FOR BEDS.—Elizabeth Calkins, St. Joseph, Mo. For holding the bedding, etc., in place, in folding beds when they are turned up, this inventor provides a simple and inexpensive construction, applicable to beds of all kinds and readily adjustable for different thicknesses of bedding. The holder is attached to the bed rail, and has jaws which engage the upper and lower sides of the bedding. The holder consists of two sections, one having a leg engaged by a pivoted notched locking plate on the other section, to hold the sections adjustably locked.

SCIENTIFIC AMERICAN

BUILDING EDITION.

DECEMBER, 1895.—(No. 122.)

TABLE OF CONTENTS.

1. Elegant plate in colors showing a residence in the Colonial style recently erected at East Orange, N. J., at a cost complete of $11,000. Three perspective elevations and floor plans, also an interior view. An excellent design well treated. S. W. Whittemore, architect, East Orange, N. J.
2. A Colonial house at Madison, N. J. Perspective elevation and floor plans. Cost complete $5,500. Architects, Messrs. Child & De Goll, New York City.
3. A Colonial dwelling at Montclair, N. J. Two perspective elevations and floor plans. Architect, W. E. Bloodgood, New York City. A unique design.
4. Two perspective elevations and floor plans of a house recently erected at Brick Church, N. J., at a cost of $2,700 complete. A pleasing design. Architect, Mr. F. R. Hassman, Orange, N. J.
5. View of the new City Hall, Philadelphia, which has been erected at a cost of over $20,000,000. The building is of white marble and covers four and a half acres. Is absolutely fireproof. The height of this building is 547 feet 3¼ inches, being, with two exceptions, the highest building on the earth. The exceptions being the Washington Monument and the Eiffel Tower. The next highest building on earth is the Cologne Cathedral, which is 510 feet.
6. View of the facade of the magnificent new Boston Public Library, Boston. Architects, Messrs. McKim, Mead & White, New York City.
7. Residence at Bensonhurst-by-the-Sea, L. I. Two perspective elevations and floor plans. Cost complete, $8,500. Architect, S. S. Covert, New York City.
8. Perspective elevations and floor plans of a cottage at Oakwood, S. I., recently erected at a cost of $2,800 complete. An attractive design.
9. Miscellaneous Contents: Testing house pipes and drains.—A combination bathtub and washstand, illustrated.—The permanence of modern dwellings and public works.—An improved steam and hot water heater, illustrated.—Moving a large factory.—How to fix paper on drawing boards.—A quick water heater, illustrated.—Improved toilet room fixtures, illustrated.—A single track parlor door hanger, illustrated.—An improved furnace grate, illustrated.—Cements in mason work.—An improved furnace, illustrated.—A regenerative gas heater, illustrated.—Improved woodworking machinery, illustrated.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6682) I. J. C. asks for a formula for giving a platinum finish on copper. A. The appearance of platinum may be given to copper by immersion in a bath composed of 1¾ pints hydrochloric acid, 7¼ ounces arsenic acid, and 1¼ ounces acetate of copper. The article must be cleaned before immersion, and left in the bath till it has the color of platinum.

(6683) A. W. F. asks how to make lye on a small scale. A. Hickory ashes are the best for making common washing soft soap (when it is not desirable to use the potash lye), but those from sound beech, maple, or almost any kind of hard wood except oak, will answer well. A common barrel set upon an inclined platform makes a very good leach, but one made of boards set in a trough in V shape is to be preferred, for the strength of the ashes is better obtained, and it may be taken to pieces when not in use and laid up. First, in the bottom of the leach put a few sticks; over them spread a piece of carpet or woolen cloth, which is much better than straw; put on a few inches of ashes and from 4 to 8 qt. lime; fill with ashes, moistened, and tamp down well—tamp the firmest in the center. It is difficult to obtain the full strength of ashes in a barrel without removing them after a day's leaching, and mixing them up and replacing. The top should be first thrown off and new ashes added to make up the proper quantity. Use boiling water for second leaching. This lye should be sufficiently strong to float a potato.

(6684) T. O'B. says: Can you give me a quick process for making vinegar? A. In this process dilute alcoholic liquor, to which one thousandth part of honey or extract of malt has been added, is caused to trickle down through a mass of beechwood shavings previously steeped in vinegar and contained in a vessel called a vinegar generator. It may consist of a large oak hogshead or barrel furnished with a loose lid or cover, a few inches below which is fitted a perforated shelf, having a number of small holes loosely filled with packthread about six inches long, knotted at the upper end to prevent their falling through. Several small glass tubes, long enough to project slightly above and below the shelf, are also fitted in perforations in the shelf to serve as air vents. The vessel at the lower part is pierced with eight or ten holes equally distributed around the sides at about 6 inches above the bottom to admit of the entrance of air. A small siphon tube, the upper curve of which is an inch below the air holes, serves to carry off the liquid as fast as it accumulates at the bottom. The alcoholic liquid, at a temperature of 75 degrees to 83 degrees Fah., is run in on the shelf and slowly trickles down through the holes by means of the packthread, diffuses itself over the shavings, slowly collects at the bottom, and runs off by the siphon exit. The air enters by the lower holes, passes freely through the shavings, and escapes by the glass tubes. The temperature within the apparatus soon rises to about 100 degrees Fah., and remains stationary at this point, while the action goes on favorably. The liquid generally requires to be passed three or four times through the cask before its acetification is complete.

(6685) J. B. asks: How much more power, if any, would be required to propel a bicycle (safety) one mile, having a front sprocket wheel of 5⅛ inches in diameter, 18 teeth, and with a rear sprocket wheel of 2¾ inches in diameter, 9 teeth, than one having both the front and rear sprocket wheels 5⅛ inches in diameter, with 18 teeth each; large wheels, 28 inches in diameter, equal conditions prevailing, excepting as to time required? A. As power is derived from both pressure and velocity, the condition named in the relative sizes of the wheels will make no difference in the actual power required to drive the bicycle. The large wheel sprocket must run faster, and with it the foot must make more treads with lighter pressure for a given distance, than in the ordinary form as first named. The only value of the last named combination is on steep, rising grades.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 17, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Electric motor, F. E. Herdman 551,628
Electric motor, Wightman & Urban 551,567
Electric motors, controlling, D. Mason 551,470
Electric motors, means for operating and regulating speed of, R. Eickemeyer 551,371
Electrical circuits, system for regulating effective tension of, H. O. W. J. Breul 551,743
Elevator, J. T. Cowley 551,630
Elevator, T. W. Heermans 551,546
Elevator mechanism, L. Christiansen 551,488
End gate fastener, A. Schlapbach 551,653
Engine. See Gas engine. Steam engine. Stone cutting engine.
Engine, F. H. Cornwall 551,366
Engine steering gear, traction, F. F. Landis 551,498
Envelope fastener, W. Barnard 551,709
Evaporator, H. A. Merriam 551,732
Excelsior machine, J. A. Gray 551,672
Eyelets, manufacture of, A. Mathison 551,508
Farm gate, J. Sweet 551,415
Fastening device for boxes, card cases, etc., C. H. Reed 551,477
Feedwater regulator, automatic, J. B. Chafer 551,719
Fence post, metallic, Ellis & Helfenberger 551,568
Fender. See Car fender.
Filter, water, I. T. Hopper 551,381
Firearm, box magazine, T. G. Bennett 551,572
Firearm, box magazine, W. Mason 551,588
Firearm, magazine, W. Mason 551,388
Fireplace heater for radiator systems, C. M. Robinson 551,651
Fireplace, portable, W. E. Fitch 551,539
Fishhook, R. H. Crane 551,591, 551,592
Fishing reel, H. W. Martin 551,550
Fishing reel, G. H. Newell 551,646
Flushing cistern, J. & W. J. Sherman 551,514
Fork. See Lifting fork.
Frame. See Curtain stretcher frame. Picture frame.
Fruit gatherer, Coulson & Reus 551,580
Furnace. See Dental furnace. Ore smelting furnace. Oxidizing furnace.
Furnace, E. Powell 551,476
Furnace grate, S. Mann 551,505
Furnaces, protecting shield for heating, smelting, or other, A. Younger 551,704
Gage. See Track gage.
Gas burner, self-generating, H. F. Smith 551,626
Gas condenser, W. L. Church 551,721
Gas engine, F. W. Coen 551,579
Gas generator, Henderson & Stapp 551,546
Gas, method of and apparatus for scrubbing, F. L. Slocum 551,695
Gas washer and scrubber, F. L. Slocum 551,694
Gate. See Farm gate. Railway crossing gate.
Gate, C. H. Brank 551,487
Gate, S. B. Sutton 551,730
Generator. See Gas generator. Steam generator.
Gloves, etc., receptacle for, A. E. G. Schmidt 551,690
Grain separator, centrifugal, F. F. Landis. 551,492, 551,494 to 551,499
Grate, fire, J. C. Birkhead 551,711
Grinding mill, C. R. Hudson 551,392
Guard lock, F. W. Mix 551,685
Halter, H. L. & C. M. Green 551,375
Hame hook, S. H. Windley 551,661
Hand rake, J. Murphy 551,507
Harness, L. T. Grubbs 551,376
Harrow, corn, A. Downing 551,435
Harrow, spading, W. P. Morgan 551,395
Harvester and shocker, corn, W. Milbrath 551,446
Harvester, corn, C. H. Hall 551,737
Hay carrier, J. G. & J. A. Piron 551,474
Heat regulator, W. W. Wilcox 551,497
Heater. See Fireplace heater.
Heater, L. S. Daniels 551,528
Hoisting and conveying apparatus, T. S. Miller 551,506
Hone, composition metal, C. B. Greene 551,673
Hook. See Display hook. Fish hook. Hame hook.
Hop tearing apparatus, G. L. Jaeger 551,677
Horseshoe, cushioned, H. H. Gibbs 551,670
Horseshoe, nailless, H. D. Shaiffer 551,407
Hub, vehicle, H. L. Stuart 551,414
Ice carrying device, W. Schildhauer 551,513
Indicator. See Station indicator.
Irrigation, means for, E. Newsom 551,646
Jack. See Stitching jack.
Jacquard apparatus, R. C. Richardson 551,510
Kiln. See Cement kiln.
Kitchen cabinet, W. Swenson 551,606
Kneading machine, dough, D. W. Bromley 551,714
Knife cleaner, H. A. H. Gahl 551,426
Knitting machine narrowing apparatus, F. H. Grans 551,689
Labeling plants, etc., appliance for, F. R. & C. J. Chapman 551,533
Ladder or other supporting device, step, H. Liefer 551,445
Lamp, forced draught, R. Hitchcock 551,736
Lamp holder, magnetic electric, M. H. Colleen 551,364
Lamp, incandescent electric, C. A. Beal 551,357
Latch, W. O. Hogaboom 551,490
Lead by electrolysis, apparatus for manufacturing white, Browne & Chaplin 551,361
Lens grinder, Buchhop & Schnackenberg 551,717
Lifting fork, E. A. Cosens 551,438
Light. See Electric light.
Liquid dispensing apparatus, W. M. Fowler, 551,540, 551,541
Lock. See Electric lock. Guard lock.
Lock, J. A. Hampel 551,602
Lock, F. W. Mix 551,684
Loom pile wire, G. Seeschneider 551,654
Loom shuttle, A. Isherwood 551,388
Loom shuttle tension device, W. A. Grant 551,658
Lubricator. See Axle lubricator.
Lubricator, H. R. Andrews 551,522
Mail bag stand, A. S. Hill 551,379
Mat, T. C. McPherson 551,644
Match machinery, B. T. Steber 551,573
Matrix for guiding pieces when being punched, C. G. Larson 551,505
Matrix making and typesetting machine, Lee & Lebrun 551,469
Metal rods, machine for treating, J. Doughty 551,532
Meter. See Electric meter.
Mill. See Grinding mill. Windmill.
Millstone dressing machine, B. F. Strickler 551,566
Mining drills and reamers, dust arrester for, R. H. Elliott 551,464, 551,465
Mining machine, E. S. McKinlay 551,508
Mole and rat trap, combined, G. W. Stephens 551,412
Mop head and wringer, combined, H. J. Gleason 551,625
Mop wringer, W. G. Archer 551,355
Motor. See Electric motor.
Motors and regulation of currents in same, mechanism for admission of currents to, F. E. Herdman 551,635
Motors, mechanism for admission and regulation of currents to, F. E. Herdman 551,634
Musical instruments, bridge for stringed, A. Renner, Jr 551,450
Nozzle, faucet, F. Keiser 551,731
Nozzle, hydraulic, F. M. Bookwalter 551,575
Nozzle, ram jet, W. F. Cunningham 551,527
Nozzle, spraying, F. Gray 551,680
Nut lock, L. O. Smith 551,737
Ore crusher, A. H. Schierholz 551,560
Ore smelting furnace, H. P. Holland 551,441
Overshoe fastener, W. S. Richardson 551,408
Oxidizing furnace, J. R. Greenawalt 551,725
Paper bags, manufacturing, D. Appel 551,611
Paper feeding machine, E. Dummer 551,724
Paper folding machine, J. W. Skillen 551,561
Paper sheets, machine for feeding and registering, E. Dummer 551,747
Paper twine, machine for making, G. L. Brownell 551,615
Pencil sharpener, A. Prader 551,402
Percussion drill, A. E. W. Meissner 551,594
Picture frame, C. F. Herbert 551,676
Pillow sham holder, F. L. Smith 551,657
Pipe coupling, L. Mullenhoff 551,738
Pipe wrench, C. P. Payne 551,689
Pipe wrench, chain, J. H. Newell 551,389
Pipes, machine for cutting out lead joints in, J. H. McConnell 551,507
Planter and fertilizer distributer, H. M. Smith 551,454
Plate bending machine, W. Spaickhaver 551,455
Pliers, Edmunds & Cooper 551,749
Pneumatic dispatch tube system, A. W. Pearsall 551,692
Pneumatic dispatch tube systems, valve for, A. B. Cambell 551,686
Pneumatic dispatch tube systems, valve for, A. W. Pearsall 551,691
Pocket, garment, J. M. Appelbaum 551,439
Post. See Metallic post.
Potato hiller, E. C. Schwingel 551,512
Powder and shot charger, W. N. Beardsley 551,710
Power, apparatus for obtaining motive, Fellows & Whitham 551,600
Precious metals, electrolytic process of obtaining, Pelatan & Clerici 551,648
Press. See Cotton press.
Printing machines, sheet gage for, S. Whitlock 551,427
Printing plate holder, E. D. Tucker 551,457
Propeller wheel, E. J. Parker 551,647
Pulley block, H. Orrock 551,726
Pump, steam vacuum, R. I. Nichols 551,400
Purse and card case, combined lady's, F. F. Braillard 551,359
Pyroxylin compound, J. H. Stevens 551,456
Radiator, J. B. Fox 551,490
Railway crossing gate, F. A. Curtis 551,722
Railway, electric, R. M. Hunter 551,587
Railway motor shield, electric, Baker & McLain 551,684
Railway rail and connection, J. Neafie 551,698
Railway rail, compound, Charles & King 551,362
Railway system, closed conduit, F. C. Esmond 551,585
Railway system, closed conduit electric, F. C. Esmond 551,584, 551,586
Railway tie, metallic, O. B. Saint 551,691
Railway tracks, construction of, W. Raymond 551,649
Railways, closed conduit system for electric, F. C. Esmond 551,587
Rake. See Hand rake.
Reel. See Fishing reel.
Register. See Cash register.
Regulator. See Feedwater regulator. Heat regulator.
Rethrasher and elevator for tailings, F. F. Landis 551,500
Ribbon holder, W. Straw 551,739
Rubber articles, process of and machine for making hollow soft, H. G. Wolcott 551,741
Ruling device, multiple, B. H. Toquet 551,659
Safe door, H. C. Stockwell 551,606
Salt shaker, H. F. Gray 551,374
Sash holder, W. L. Hellinger 551,430
Sash holder, W. E. Dowling 551,686
Saw, E. Vieweg 551,458
Saw filing machine, J. C. Ballew 551,708
Saw, folding log, A. R. Shaw 551,409
Sawmill appliance, Hinkley & Fitzgerald 551,636
Saw teeth, implement for dressing sides of, H. C. Burnett 551,718
Scaffold, extension, A. Doolittle 551,434
Scissors for splicing purposes, J. A. Myers 551,555
Screen operating mechanism, window, F. S. Leary 551,663
Separator. See Grain separator.
Sewer or water closet plunger, P. F. O'Conner 551,598
Sewing machine table, G. L. Gray 551,671
Signal. See Car signal.
Signal, T. E. Ward 551,600
Skate ankle brace, J. C. Lee 551,444
Sleigh runner attachment, W. H. Millspaugh 551,564
Soap, making, E. J. T. Digby 551,728
Soldering machine, M. Jensen 551,491
Spinning machine yarn separator, A. D. Chandler 551,431
Stair rod, A. W. Findlay 551,437
Stamp battery, C. Raleigh 551,448, 551,449
Stamp holder and ink pad, combined, J. H. Kleine 551,642
Station indicator, C. E. Larrabee 551,502
Steam boiler, A. S. Krotz 551,500
Steam boiler, C. W. Wagner 551,419
Steam engine, E. A. Sperry 551,490
Steam generator, water tube, E. D. Meier 551,393
Stitching jack, A. R. Knadler 551,399
Stone cutting engine, W. B. Murray 551,687
Stop motion mechanism, self-registering, H. F. Straw 551,698
Stopper. See Bottle stopper.
Store service apparatus, J. T. Cowley 551,618, 551,619
Store service apparatus, J. H. Goodfellow 551,626, 551,627
Store service apparatus, adjustable curve for, Gayton & Cowley 551,624
Stove burner, gas, I. Brooke 551,715
Stove, heating, I. Brooke 551,716
Stove, heating, F. Kaempen, Jr. 551,640
Stove, laundry, W. I. Gong 551,373
Stove, oil, Gallagher & Adler 551,406
Stoves, ranges, etc., grate for, C. P. White 551,518
Sugar for confectionery, preparing, E. Shaw 551,655
Switch working mechanism, R. W. Farrell 551,538
Tablet, manifolding autographic, W. Assheton 551,706, 551,707
Tank. See Water tank.
Telephone exchange system, automatic, W. F. Lounsbury 551,391
Telephone receiver holder, F. W. Martland 551,551
Telephone transmitter, T. Grissinger 551,674
Teletyper, C. Spiro 551,515
Thrashing machine, P. E. Good 551,542
Thrashing machine separator attachment, C. E. Maagard 551,679
Tire, bicycle, O'Neill & Halle 551,471
Tire, bicycle, A. B. Shaw 551,408
Tire for bicycles, pneumatic, F. Douglas 551,533
Tire tightener, W. S. Hale 551,675
Tire, vehicle, C. J. Wagener 551,481
Tool holder, C. L. Alexander 551,610
Track gage, Donovan & Behan 551,622
Tramway for hoisting and dumping apparatus, Bruce & Marcus 551,745
Transplanter, J. Walter 551,421
Trap. See Crab trap. Mole and rat trap.
Trolley wagon, G. H. Hulett 551,566
Trousers stretcher, A. Taeschner, Jr. 551,658
Truck, J. K. Proctor 551,403
Truck frame plate, car, B. Bagshawe 551,588
Truck, railway car, R. F. Minor 551,683
Type-containing channel, Johnson & Low 551,386
Type holder, Johnson & Low 551,387
Typesetting apparatus, Johnson & Low 551,384, 551,385
Typewriting machine, W. P. Quentell 551,404
Typewriting machines, cushion for keys for, Graham & Savell 551,543
Undergarment, H. L. Shaver 551,604
Universal clamp, A. O. Benecke 551,358
Valve, engineer's brake, G. W. Hayden 551,378
Valve, float, J. W. Chamberlain 551,577
Valve, flushing, E. L. Powell 551,475
Valve system, air brake, H. Taber 551,416
Vehicle body, M. Woodhull 551,706
Vehicles, traction mechanism for self propelling, C. W. Parks 551,472
Velocipede, ice, F. J. Korff 551,442
Velocipede, marine, G. F. Cremer 551,367
Velocipede, railway, J. Donovan 551,623
Ventilator, C. Seewald 551,608
Ventilator, L. Silberman 551,453
Vessels, stern frame and rudder for, J. R. Oldham 551,509
Veterinary mouth speculum, H. F. Condon 551,462
Vise or cramp for holding bits or other parts of harness while being cleaned, G. Wilson 551,468
Wagon brake, D. A. Williams 551,608
Wagon, coal, J. E. Walsh 551,420
Wagon seat attachment, Uncapher & Deplanty 551,740
Water tank, antifreezing, H. F. Winkelmann 551,662
Wheel. See Carriage wheel. Propeller wheel.
Wheel, C. H. Wilmerding 551,609
Wheel rim, vehicle, G. E. Blake 551,713
Windmill, F. P. Shepard 551,410
Window bead fastener, A. P. Read 551,405
Wire stretcher, H. A. King 551,678
Wool, extracting fat from, P. C. McIlhiney 551,396
Wrapping machine, newspaper, L. C. Crowell 551,463
Wrench. See Pipe wrench.
Wrench, O. H. Hanson 551,467
Wringer. See Mop wringer.
Writings or drawings, apparatus for making reproductions of, J. Wilson 551,428

DESIGNS.

Bicycle saddle, C. O. Cutting 24,988
Box, wooden, W. C. Estes 24,991
Brushes, etc., back for, P. O. Dickinson 24,981, 24,982
Carpet, C. Casseneuve 24,993
Dish, covered, A. A. Lanternier 24,984
Egg cup, W. S. Farrington 24,983
Flag, F. C. Bliss 24,992
Game board, W. B. Smedley 24,987
Kite, F. Blauss 24,989
Picture frame, C. B. Barker 24,986
Statuette, L. Hornberger 24,985
Steamers, casing for face, C. A. Butler 24,990

TRADE MARKS.

Antiseptic for internal and external use, F. von Heyden Nachfolger 27,482
Cakes, crackers, and the like, Crosier-Stauffer Company 27,477
Coal, derivatives of, Gas Light and Coke Company 27,480
Flannels, B. W. Titus' Sons 27,486
Flour, wheat, Charles Tiedemann Milling Company 27,478
Gin, S. Streit & Company 27,476
Leather, tanned, Frank Tanning Company 27,487
Medical remedies, certain named, L. W. Pigott 27,484
Medicines for gout, sciatica, rheumatism, and kindred diseases, Rheumatox Company 27,483
Packing for steam joints, gaskets, and the like, sheet, C. L. Ireson 27,488
Papers, fine writing, Hampshire Paper Company 27,475
Plows and cultivators, Heilman Plow Company 27,491
Preparations for blemishes and diseases of the skin and scalp, and nasal, throat and lung troubles, M. Tolquet 27,481
Roofing felt, Mica Roofing Company 27,489
Soap, A. W. Stadler 27,479
Starchers, shirt, collar, and cuff, Weldon & Stites 27,485
Wringers and mangles, American Wringer Company 27,490

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

INDEX.

ILLUSTRATIONS.

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

THE SUBMERGED PIPE LINE ACROSS the Willamette River at Portland, Oregon.—By F. and A. S. Riffle. Description of a line of 28-inch cast iron submerged pipes forming portion of the main line constructed during 1893 and 1894, to supply the city of Portland with pure water from Bull Run, a mountain stream thirty miles distant. With 13 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1019 and 1020. Price 10 cents each. To be had at this office and from all newsdealers.

TEA AND ITS EFFECTS.—BY JAMES Wood, M.D. An interesting paper discussing the relative position of theine among other stimulants and the physiological actions that it is capable of exerting. Analysis of the tea leaf. Analysis of symptoms in theinism. Effects of tea on the nervous system. Comparative actions of theine and caffeine. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1011. Price 10 cents. To be had at this office and from all newsdealers.

THE SIMPLON TUNNEL.—DESCRIPTION of the project for a tunnel through the Pennine Alps under Monte Leone, which, when completed, will be the longest in the world. Nature of the rock to be traversed, proposed system of construction, ventilation and cooling, hygienic arrangements, outside erections. Full details, with 11 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 998, 999, and 1000. Price 10 cents each. To be had at this office and from all newsdealers.

For Sale.

The whole or part of valuable patent on an Awning constructed on principle of Venetian Blinds. Adapted to be folded up over door or window and used for ventilating, shelter from sun's rays or rainy weather. For particulars, address C. LECLERCQ, care Munn & Co., 361 Broadway, New York.

PROPOSALS.

PROPOSALS FOR ERECTION OF MEMORIAL Hall, West Point, N. Y.—Office of Post Quartermaster, West Point, N. Y., December 14, 1895.—Sealed proposals in triplicate will be received at this office until noon, Monday, January 13, 1896, for the construction of a Memorial Hall. Plans can be seen and forms and specifications obtained at this office or at the office of Messrs. McKim, Mead and White, Architects, 160 Fifth Avenue, New York City. The right is reserved to reject any and all proposals. J. B. BELLINGER, Captain and A. Q. M., U. S. Army.

MANUFACTURE OF STARCH FROM Maize.—By J. Kriegner. Full details of the process. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - - 75 cents a line
Back Page, each insertion, - - - $1.00 a line

For some classes of Advertisements, Special and Higher rates are required.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

YOU can't tell a balky horse by his looks and you're just as likely to be deceived in a bicycle. There's no better guide when buying a wheel than this famous name—

Monarch

It identifies the king of wheels—it's a guarantee of strength, speed and reliability. A name that you can proudly point out to your friends.

4 models. $85 and $100, fully guaranteed. For children and adults who want a lower price wheel the Defiance is made in 8 models, $40, $50, $60, $75. Send for Monarch book.

Monarch Cycle Mfg. Co.
Lake, Halsted and Fulton Sts., CHICAGO.
BRANCHES:
New York, San Francisco, Portland, Salt Lake City, Denver, Detroit, Toronto.

Any Boy

that will take the trouble to send for a

"Rugby" Watch

CATALOGUE, No. 61, will know more about what we have made for them in

WATCHES

than they would learn by reading a page of advertisements.

Our entire new line of Boys' Watches is elegant in designing and with every taste.

The "Rugby" Catalogue will tell the story.

The Waterbury Watch Co.
WATERBURY, CONN.

AGENTS WANTED. WRITE FOR CATALOGUE AND AGENCY. FINE TOOLS IN EVERY SHOP. C. H. BESLY & CO. CHICAGO, ILL. U.S.A.

THE TIN PLATE INDUSTRY IN THE United States.—An interesting paper, showing the extraordinary development of the tin plate industry in this country, and the serious competition into which it is now entering with the British industry. With 19 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1019, 1020, 1021, 1022 and 1023. Price 10 cents each, or 50 cents for the series. To be had at this office and from all newsdealers.

The American Bell Telephone Company,

125 Milk Street, Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

Wm J. Montgomery agt. 17 E. Catharine st.

DAIMLER MOTOR COMPANY,

BUILDERS OF

Highest Grade Single and Twin Screw Launches.

Safest, cleanest and speediest power boat built. No smoke or smokestack, no boiler, no electricity. No steam or naphtha under pressure. Run on one pint of gasoline per horse power per hour, and are under way in less than one minute. No licensed engineer or pilot.

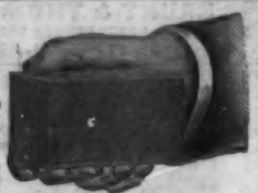
Also Stationary Motors.

Send for Illustrated Catalogue and Price List.

OFFICE AND WORKS, "STEINWAY," LONG ISLAND CITY, N. Y.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

DOES ANY-THING PHOTOGRAPHIC—



The Pocket Kodak.

Pocket Kodak, loaded for 12 pictures, 1½ x 2, . $5.00
Developing and Printing Outfit, . . . 1.50

EASTMAN KODAK CO.
ROCHESTER, N. Y.

Sample photo and booklet for two 2-cent stamps.

SKATE SHARPENER ...

POSTPAID, 30 CENTS.

The only sharpener making a Concave or Square surface. Works like a plane. Weighs only four ounces. Easily operated and will last a lifetime.

Write for Catalogue of Skates and 5,000 interesting Tricks and Novelties.

PECK & SNYDER, 130 Nassau Street, NEW YORK CITY.

THE FADING OF PIGMENTS.—A PAper by Capt. W. DeW. Abney, discussing the action of the various rays of the spectrum upon colors. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1016. Price 10 cents. To be had at this office and from all newsdealers.

EDGE TOOLS

are often nearly ruined by using a grindstone not adapted to the work. Our quarries produce a large variety of grits suitable for grinding any tool.

May we send you our Catalogue, which will give you some information?

GRAFTON STONE COMPANY,
No. 80 River Street, GRAFTON, OHIO.

"IMPROVEMENT THE ORDER OF THE AGE."

Three New Model Smith Premier Typewriters

Nos. 2, 3 AND 4

HAVE YOU EXAMINED THEM?

Many Improvements Heretofore Overlooked by Other Manufacturers.

Address THE SMITH PREMIER TYPEWRITER COMPANY, Syracuse, N. Y., U. S. A.

BRANCH OFFICES IN TWENTY-NINE PRINCIPAL CITIES IN THE UNITED STATES.

... WE ARE BUILDING ...

The Celebrated

"HORNSBY-AKROYD" OIL ENGINE

The De La Vergne Refrigerating Machine Co.
FOOT E. 138TH STREET, NEW YORK.

"OTTO" GAS AND GASOLINE ENGINES.

¼ to 100 h. p. Can be used in cities or in country independent of gas works or gas machines.

No Boiler, No Danger, No Engineer.

OVER 35,000 SOLD.

The Otto Gas Engine Wks., Incorp'd, Philadelphia

Bristol's Patent Steel Belt Lacing.

The simplest, cheapest and most perfect Belt Fastening for all kinds of belting. *Samples sent free.*

The Bristol Co. Waterbury, Conn.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

PRIESTMAN SAFETY OIL ENGINE

"Phenomenally low in cost of operation."—Franklin Inst.

NEITHER STEAM NOR ENGINEER Kerosene, NOT Gasoline

Economical, Simple, Safe, Automatic. For Electric Lighting, Pumping, Milling, etc.

PRIESTMAN & COMPANY, Inc.
Front and Tasker Streets, - - Philadelphia

BOSTON ELECTRIC RAILWAY SUBway.—Description of a new subway system under certain streets of Boston, by means of which the electric cars will be diverted from the surface of the streets on some of the heaviest lines of travel. With 8 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1017. Price 10 cents. To be had at this office and from all newsdealers.

GASOLINE ENGINES.

1½ to 15 horse power. For Propelling Boats of all kinds. Cheapest Fuel, Absolute Safety, No Licensed Engineer, Simple Construction, Hundreds in Successful Use.

Write for illustrated catalogue.

GLOBE GAS ENGINE CO.,
Merion Avenue & 49th Street. PHILADELPHIA, PA.

There is hardly a USE OF POWER

in Factory, Mill, Store, Office, Elevator, Creamery, or Shop—or on the Farm, the

"CHARTER"

is not now filling. It is also running Boats, Well Drills, Pumps, Dynamos, Threshing Machines, etc. Of course it also uses Gasoline.

CHARTER GAS ENGINE CO., P. O. Box 148, Sterling, Ill.

Waverley Bicycles.

Ridden by the Elite

Of both continents.

Elegant in Design,

Superb in Finish.

THE ACME OF PERFECTION IN CYCLE CONSTRUCTION.

Art catalogue describing ladies' and gentlemen's models free by mail.

INDIANA BICYCLE CO., INDIANAPOLIS, IND.

Do You Play Cards?

Above ¼ actual size.

Send two-cent stamp and we will mail FREE

Our SOUVENIR GAME COUNTER

ENGINES, Boilers and Machine Tools. New and Second-hand. Send stamp for paper "Machinery & Supplies." W. P. Davis, Rochester, N. Y.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LD 91 JOHN ST NEW YORK

At ¼ Price Bicycles, Watches, Guns, Buggies, Harness, Sewing Machines, Organs, Pianos, Safes, Tools, Scales of all varieties and 1000 other articles. Lists free. Chicago Scale Co., Chicago, Ill.

ALCO VAPOR LAUNCH.

Engine and helm controlled from bow. Latest improved and only 12 to 1 motor now ready for the market. 18 to 40 ft. launches 2, 3, 5 and 7 h. p. No licensed engineer or pilot required. *Speed and safety guaranteed. No dangerous naphtha or gasoline used.*

Marine Vapor Engine Co., Jersey City, N. J.

- - THE - -

Scientific American

ESTABLISHED 1845.

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage.

Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of Three Dollars by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Postmasters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT, for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN BUILDING EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates* and other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Floor Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., 361 Broadway, New York.

Export Edition

of the SCIENTIFIC AMERICAN, with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN is published monthly, and is uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places *throughout the world*. $3.00 a year, postpaid, to any part of the world. Single copies, 25 cents.

Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost. Rates upon application.

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York